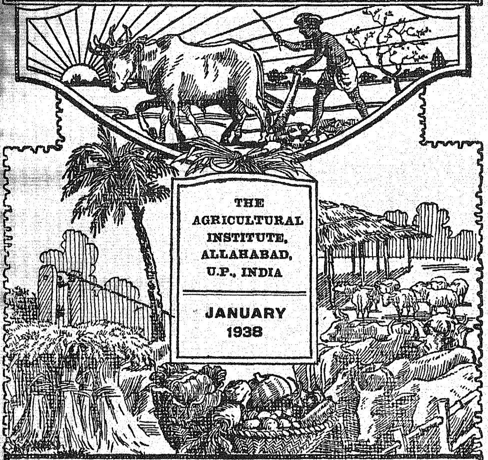
VOL. XII] [No.

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



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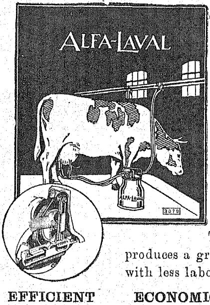
WEBSTER.



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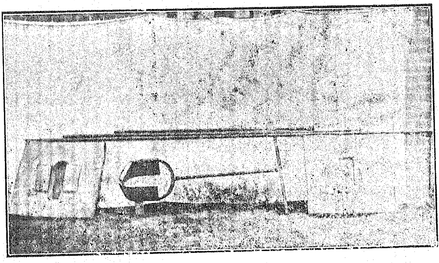

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"The bore-hole latrine combines utility, and sanitation, and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

The Allahabad Farmer

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MANAGING COMMITTEE

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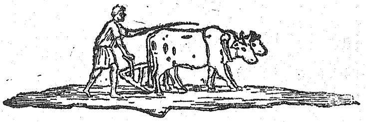


VOL. XII] JANUARY, 1938 [No. 1

Editorial

The New Year

The year 1937 is gone and the new year is now with us. The old year 1937 will be remembered in the annals of this country as one of the most memorable years in Indian history. In this year the country took another forward step towards self-government. The year will especially be remembered as one in which the Congress Party took charge of the reins of government in seven out of the eleven provinces of India. The close of the year 1937 saw in this country the beginnings of sweeping changes in this country which have gladdened the mind of the great mass of the suffering people of India. The year 1938 therefore ushers in great hopes for the cultivators of the soil. They are looking forward to better times ahead of them. Poverty, want and suffering as they are known today will, it is expected, disappear one by one from the country. These are great hopes. Let us therefore watch and see what the year 1938 has in store for us.

In the meantime we wish all our readers a Very Happy and Prosperous New Year, and we do hope with the rest of the people of India that better times are ahead

of us. May we therefore all work together towards the realization of these great hopes and thus help to relieve the distressed and bring prosperity and hope to every home throughout the country.

* * * *

The Indian Science Congress

In the course of the last twenty-five years the Indian Science Congress has definitely established itself as one of the most important organizations which we have in the country. Its beginnings twenty-five years ago were inostentatious and rather humble, and it included only such sciences as Physics, Chemistry and a few others. But the organization has gone on from strength to strength that it now includes such varied subjects as Astronomy and Anthropology, Agriculture and Medicine and a host of other sciences which have developed during the last twenty-five years. We more especially welcome the importance the Indian Science Congress has given to agriculture during the last few years. Agriculture is now being considered as much a science as Chemistry, Phyics or Botany. In fact those who are acquainted with agriculture realize that the subject is not only the practical application of all the sciences, but that in agriculture the inter-relations of the different sciences are brought out more clearly than in any other field of science that they know of. Take for instance such a subject as soil or to use a more common American expression 'dirt.' This subject in itself cannot be properly understood unless one understands the various chemical, physical, biological and other factors involved in it. More recently a branch of mathematics or, to be more exact, statistical methods of analysis are being increasingly used in the solution of such problems as the need for a fertilizer or the effects of different treatments on the soil. An agricultural scientist therefore has to seek the help not only

of Botany as is more commonly understood, but of such other sciences as Chemistry, Physics, Bacteriology, Zoology, Mathematics, etc., for the solution of his problems. It is therefore very encouraging to see that students of every branch of science in India are being brought together in one central organization, the Indian Science Congress, a body that can review the work of the scientists all over India.

There is a great deal of pseudo-science that is being learned and taught in many institutions in India, especially in the field of agricultural science, as the work in this subject has not been properly reviewed and scrutinized by men who should be in a position to do so. Such knowledge as has not been proved and tried under varying conditions, when broadcast may do more harm than good to the welfare and progress of agricultural science in this country. The Indian Science Congress through its deliberations helps a great deal towards the clarification of the issues involved in agricultural studies and in the interpretation of the results of the experiments and researches now being obtained in different stations throughout the country.

We are happy therefore at this time to wish the Indian Science Congress, in this its twenty-fifth year, a more useful career in the future. The Silver Jubilee of the Indian Science Congress is being properly celebrated in Calcutta, the home of its origin, where not only scientists from India but from England and other parts of the Empire will gather together and take part in its deliberations. T' e Science Congress has been very fortunate during its recent years to count among its patrons, some of the leading princes of India. When Science is enthroned not only in institutions of learning but in palaces, and also in the homes of the common people of India, then we are sure to see this country make as rapid advance as some of the countries of the West have done in the last few hundred years.

Molasses as a Fertilizer

One of the best expositions of the values of molasses as fertilizer appeared in an article of one of our contemporaries. The article was written by Prof. V. Subrahmanyan of Bangalore.

The writer of the article says that the application of molasses to the soil has long been found to produce very different results; it may either result in a phenomenal increase in crop yield or in no increase at all or in a very depressed yield. This curious phenomenon has not been properly explained. But as the result of the recent work of Sundara Iyengar and others it has been found that one of the immediate products of decomposition of molasses is ferrous iron which is highly toxic to plants. Its presence therefore even in very minute quantities has a very depressing effect on crop yields. But when ferrous iron is exposed to air it is rapidly converted to ferric oxide which is known to be highly beneficial to crop plants. Ferric oxide also has been found to rapidly release plant foods, to increase the evolution of carbon dioxide and to stimulate the development of soil bacteria.

Now the amount of ferrous oxide and also its conversion into ferric oxide depend on several factors such as the mechanical composition of the soil, the available air supply, the temperature and various other factors. For proper fermentation of the molasses however, the writer seems to think that the anaerobiotic conditions are necessary in some stages of its decomposition. The writer also believes that the combination of molasses with lime would prove highly beneficial.

Agricultural Reports

The monthly agaicultural reports which appear towards the end of this issue have been kindly supplied to us by the Department of Agriculture of this province. The reports will appear regularly in this magazine.

SELECTION OF A TYPE OF FARMING

By B. M. Pugh

In view of the fact that several educated young men throughout the country are seriously thinking of taking up farming, some suggestions are given herewith in order to help them decide as to which type of farming they wish to follow.

At the outset it may be mentioned that there are different types of farming. There is what is called "specialized farming" in which a person obtains at least fifty per cent of the gross income on the farm from one main product or industry, such as sugarcane, tobacco or milk, etc., whereas if a farmer obtains less than fifty per cent from any one product, such a farm is commonly known as a "diversified farm."

Both these types have their special advantages and disadvantages however. Specialized farming for example, may usually be started with a smaller amount of capital. It also usually requires less land. And as it has only one main industry the others being more or less subsidiary to it, it gives the farmer better opportunities to specialize, that is, to study more in details, the requirements of that particular industry. Consequently the work in connection with that one industry is usually done better than when more than one industries are followed.

But diversified or general farming also has its special advantages. Firstly, general farming allows a more efficient use of labour on the farm. A one crop farming, for instance, will usually have its busy seasons and its slack ones. But when there is a great diversity of crops on the farm, labour may always be employed in working with one crop or another. Secondly, in general farming, the returns are regular; that is, the farmer usually will receive cash almost throughout the year from his various crop enterprises or various industries on

the farm. Thirdly, in general farming a farmer can follow different systems of cropping, that is the same crop does not have to be grown in the same field every year. Hence, in general farming, some definite crop rotation may be followed. This practice is known to conserve the fertility of the soil and is not so exhaustive to the soil as the practice of growing the same crop every year on the farm.

In general, therefore, a certain degree of diversity on the farm is considered to be a good practice.

One who expects to be a farmer would have to choose again one of the various types of farm business such as (*i*) fruit farming, (*ii*) grain farming, (*iii*) live-stock farming, etc. When choosing any of these types several factors have to be taken into consideration.

1. *The factor of climate.*—This is probably one of the most important factors which determines the type of farming in a region. We are familiar with the fact that rice, the greatest staple food of this country, is mainly grown in three or four of the provinces of India, chiefly because of the climate in those regions. Wheat on the other hand, is confined to Northern India because of the climate which prevails in those regions and which is particularly suitable for the production of wheat.

2 *The soil factor.*—The climate being the same, the character of the soil in a locality and even on the same farm determines the kinds of crops that may be grown on any particular farm. Thus, whereas such crops as rice require a heavy soil other crops such as potato, barley and 'bajra' are usually grown in lighter soils. Cotton in this country is mostly grown in the black cotton soils of western and central India as the soil and also the climate where this type of soil occurs are particularly suitable for the production of this crop.

3. *Transportation.*—This is another very important factor determining what type of farm business or what crops can be grown in the locality. A principle that is generally followed is to produce those that are easily

and cheaply transported at places somewhat distant from the centres of population, because near big cities and towns those products that are somewhat bulky and are perishable would be produced. Now butter, for example, may be produced wherever the cattle may be fed as cheaply as possible; but liquid milk can only be produced profitably near the consumer as it is both perishable and bulky for its value. Again, small grains such as wheat and barley cannot usually be grown very profitably near big cities or towns as they cannot compete successfully with vegetable crops which, in general are bulky and perishable and are therefore to be grown very close to cities. And, within comparatively recent years, the development of municipal sewage farms has made possible the raising of vegetables and fruits that the farmer finds it no longer profitable to grow grain crops near cities.

The distance to market, the methods of transportation, the character of the road, all these are factors which determine to a very great extent the type of farming business that can be followed in a region or a locality.

4. *The factor of supply and demand.*—For instance the acreage of potato near big towns in northern India is mainly determined by the demand of the market in those towns, as most of the potato is consumed locally. Potatoes grown in the hill stations and to some extent in Farrukhabad and other places in the United Provinces, are however shipped to distant places more especially when those are to be used for seed purposes. In the same way the growing of sugarcane during the last few years has increased considerably because of the greater demand for sugarcane at the sugar factories. This is another chief reason why sugarcane is grown more extensively in the wheat regions of Northern India and not so much in the rice areas where the climate is more suitable for the production of sugarcane.

5. *The type or system of farming in the region.*—Under most conditions, it is usually more advisable to

follow the same type of farming as the one found in the locality. There is usually a great deal to learn about farming that one man cannot hope to learn it alone. The experience of the farming community in any particular region is therefore of very great importance to an intending farmer. However, many small towns in India today are short of fodders, vegetables, fruit and milk. These conditions may give a chance for some man who has a little capital to make a good profit by following a type of farming entirely different from the type generally followed in the community.

6. *Capital.*—Some types of farming require much larger capital than others; some require that the money be invested for a long time; others bring quick returns. In general the farmers with little capital raise more crops for sale. Live-stock farming requires much more capital than crop farming, for with any given farm, the animals represent added capital. In general, fruit farming also requires a much larger capital at the initial stages than grain farming.

7. *Diseases and pests.*—Certain diseases and pests of plants and animals are a limiting factor to certain types of farming. One of the factors that have held back the development of the cattle raising in this country is the occurrence of such diseases as hoof and mouth, rinder pest and many other terrible diseases that affect the cattle industry of the country. The appearance of the San Jose scale in Kashmir may, if not controlled, probably wipe out the apple and peach industry in the State. The appearance of certain forms of blights with several crop plants has made the growing of those crops generally unprofitable.

One would therefore be well advised to consider carefully all the problems that may crop up in the business of farming before he launches himself seriously into the business. With careful planning and organization there is no reason why farming should not be found to be a profitable business in this country.

CAPON

By W. R. Chester

Chickens are raised principally for the eggs they will produce. In order to get eggs, pullets must be raised. Along with the hatching of pullets, an equal number of undesirable cockerels will result.

No business, not even a silver mine, could operate at a profit were it necessary to spend one rupee in order to coin another. Yet some poultry raisers try to handle poultry exactly that way.

Cockerels of each flock can and should be made as profitable as pullets. Cockerels marketed as capons are often a very profitable part of the poultry business. There is no secret hidden in making capons out of young cockerels. The removal of two small glands (testes) early in the life of each young cockerel brings a wonderful change. The glands develope in most breeds when they are six weeks to two months old. As the glands develope the bird's comb and wattles become enlarged, and once the glands are removed a wonderful change occurs in the bird: his comb and wattles cease to grow, and the desirable flesh developes both in quantity and quality as the capon matures.

As a father-brooder capon beats a mother-hen, capons (specially of heavy breeds) love baby chicks. A capon will scratch for, chick to and hover baby chicks better than some of the *desi* hen.

In selecting capons to use for brooding baby chicks, only the gentle, tame ones should be used. Put the capon in a yard before the baby chicks come out. Put no perches, so the capon will roost on the floor. Do not put baby chicks with him until he is established and feels at home in his new quarter. Handle the capon to tame him every day, so he will not be afraid or become excited when the baby chicks are offered to him. When everything has been arranged, put the baby chicks before

him in the evening soon after he goes to roost. A well-tamed capon will not refuse the offer.

Usually the first morning, this new father will be seen enjoying with his babies. If he is seen acting bashful or refuse to chick, take all the babies away from him at once, and confine him in a dark place. Repeat the second night proceedings as at first. By the second morning he will be all right.

Proper preparations make caponizing easy and safe. For the best results the young rooster must be at the right stage of sexual development. The little glands should be removed when they are about the size of the garden pea or common bean, and in no case later than this. Different breeds and different flocks of the same breed vary as to the time of development. Proper feeding is also a factor. No set rule that would be just right in every instance can be given. Generally speaking, this may be done when the bird of a light breed weighs one to one and a half pound and a bird of a heavy breed weighs one and a half to two pounds.

Each young cockerel has two golden glands (testes) hidden in a sack inside. If the bird is full of feed and water, his inside equipment will be full and floating round the glands. Because of this it is very essential to prevent the bird from having feed or water for at least thirty-six hours just before the operation is to be done. A good light is important, but do not operate in the middle of the day when it is too hot; mornings or evenings are preferable.

When all the necessary arrangements for the operation are made, put the bird on the table in a good light. Take a string and tie its wings with one end and to the other end tie a light weight and hang it freely. Then take another string and tie its legs and do the same here also: it will keep the bird in a stretched position. Now the bird is secure and you can handle it any way you like.

Pluck the feathers just in front of the hip joint. Locate the last ribs with your forefingers of the left

hand. With the right hand place the blade of the knife between them. Hold it there with a steady and firm pressure, and draw it towards you. Make the cut about one inch long. This will separate the ribs. If the cut is made at the first attempt no blood will flow. Insert the spreader and open the wound. A thin membrane will be seen covering the intestines. With the tearing hook make a hole which will expose the upper gland lying up against the back bone. Care must be taken not to cut the artery lying just at the back of it, otherwise the bird will die.

Insert the remover and very carefully hold the glands inside the loops. Turn the remover half way round once or twice to loosen the gland as much as possible. Then draw it up slowly and carefully. If the bird is tough and the gland does not come loose easily, take the knife and cut all the connecting cords. Turn the bird over and repeat the operation on the other side as before. It is possible to get both the glands from the same side, but it is hard and more dangerous. Sew up the wound and apply some tincture of iodine externally. Give the feed and water to the bird at once as usual.

Separate them for two days at least and feed slightly to whatever they are accustomed to. In three or four days after the operation the capons may be allowed the free run of the place. Capons require the same feed as other poultry, they will do better on free range. Plenty of green food is a great help.

It is the farmers who along with the small poultry raisers should market most of the capons each year. Co-operation between the poultry raisers in making capons of the surplus young roosters will result in a steady poultry market the year round on all grades. It is this intelligent and rightly directed effort that will bring prosperity to each poultry raiser, nay even to the farmers, as it is one of the few available means to free them from the iron grips of economic depression.

THE APPLE

BY A STUDENT

The apple (*Pyrus Malus* L.) belongs to the family Pomaceæ. This family is of wide geographical distribution, there being close to 225 species within about 20 genera. Most of the species occur in the north temperate zone.

The apple grows wild throughout Europe, except in the extreme north, and in the country lying between the Caucasus and Persia. It also occurs wild in the mountains of the North-west of India. It is very probable, therefore, that the apple originated in the country stretching from Europe to the Caspian Sea, and that its cultivation in Europe dates back to prehistoric times.

In the apple, all rapid-growing shoots develop only leaf-buds. Flower buds, which in the apple are "mixed buds," are almost always borne on the ends of the "spurs". Further the spur must be two or more years old before it will bear fruit. Some varieties however, produce fruits in the axils of the leaves and some also bear fruit on one-year old spurs. Fruit buds cannot be easily distinguished from the leaf buds of the apple. As a rule, however, leaf buds are smaller and more pointed.

The fruit of the apple is a pome, that is, a false fruit in which the torus or receptacle becomes fleshy to form the greater portion of the fruit and encloses five bony, leathery or papery carpels.

The apple as a rule is cross-pollinated and honey bees are very important agents in bringing about cross-pollination. They are attracted by the nectar which is produced rather abundantly. Many apples are self-sterile. In such cases pollen from another variety will usually result in fertilization. This condition, however, seems to vary with different climatic conditions.

There are altogether more than 500 different varieties of apples. Out of this great number however, only a few

of them make up a great deal of the commercial apple production of the world.

While climate and soil determine what varieties are to be grown they also determine whether apple could be grown in any locality. Again while we can to some extent modify the soil we cannot modify the climate of the place. Hence climatology is one very important phase in fruit growing.

The relation of the climate to the plant have been studied for hundred of years and several theories have been proposed to explain this relation. The first theory is that a given plant requires a certain amount of heat (expressed in heat units) to complete its cycle. The effective heat units have been taken to be anything above 5°C or 41°F. The main objection to this theory is that it assumes that above a certain basic temperature which initiates plant growth, each rise of one degree is equal with any other. Others also believe that sunlight has an effect on the plant which is independent of the temperature.

For all practical purposes, however, it may be stated, that the apple will do well where the range of temperature does not exceed 20 degrees. The conditions under which the tree can withstand this temperature again depend on (1) the variety of the apple, (2) the maturity of the tree, (3) the question of moisture, and (4) the daily range of temperature. Another climatic factor is the temperature during the summer. It is possible from the results of investigation to group apples according to this mean temperature, at which an apple tree will produce fruit at its best and any deviation from this temperature will produce a fruit of inferior quality. Some of the effects of a low summer heat are enumerated as follows :—(1) decrease in the colour of the fruit, (2) increased acidity, (3) decrease in size of the fruit, (4) increased content of insoluble solids, (5) apple scald in storage, and (6) increased astringency. On the other hand the excessive temperatures would tend to produce the following effects:—(1) lack of colour,

(2) poor flavour, (3) decrease in size, (4) uneven ripening, (5) poor storage qualities, and (6) mealiness and premature dropping.

The other important climatic agencies are rain and frost. Rain, during the period of bloom is probably the most important climatic factor in controlling the yield of fruit. Rain when it continues for two or three days during the period of pollination, prevents the transfer of pollen by insects, hence the low yield. Frosts are also injurious. Two suggestions may be made towards avoiding frost injury: (1) select your site if possible near a body of water, and avoid air pockets. This is a preventive measure. (2) Orchard heating to raise the temperature during time of frost helps to prevent its occurrence.

With regard to soil requirements we may say that the apple, like other crops, requires a deep well-drained soil. But there is a wide range of soils of this description and careful investigation shows that certain varieties will grow well under certain soil conditions.

Water is also a very necessary element in the plant. It exists in the plant not only as its constituent but also as a plant nutrient and is indispensable in the manufacture of carbohydrates. Different plants however have different water requirements, and this requirement is dependent upon (1) nutrient supply, (2) method of cultivation, and (3) light. The amount of water available, therefore, should determine the distance in planting, etc.

The increase of moisture shows increase of vegetative growth up to a certain limit which is optimum for growth. There should also be an abundant supply of moisture during the period of early growth. An abundance of moisture supply generally increases size of fruit and stimulates regular bearing.

The problem of planting an orchard will next be considered; and this subject, at best, can only be outlined in this paper.

First, we have to prepare the land for an orchard. This is done by ploughing followed by rolling and har-

rowing. When this is done we have to determine the plan for laying out an orchard. The contour of the land and the size of the orchard will largely determine this plan. Then the system of planting has also to be considered. We have for instance (1) the square system, (2) the triangle system (3) the quincunx system, and (4) the hexagonal system. Taking everything into consideration the square system is probably the most convenient method of planting.

Since most of the tree-fruits do not come true when propagated from seed, it is necessary to provide a root or stock on which to graft or bud them. The subject of propagation of the apple, along with other fruits is therefore important.

Some of the considerations in the selection of the stocks and scions are (1) the influence of stock on scion, namely with regard to stature, form and, seasonal changes, hardiness, disease resistance, yield, quality, and longevity; (2) the influence of scion on stock, namely with regard to the vigour of the roots, their distribution and character, the longevity, the growing season and hardiness of the tree. As yet, however, these relations are little understood, except that the influence is quantitative.

It is advisable to use farm manure in the orchard before the trees have been set out. After the trees have been planted however it is not necessary to apply manure every year.

Of late years much attention has been given to the study of insects and diseases attacking fruit trees, that it is almost impossible to mention all the pests which are found on the apple. In this article, therefore, only those that are of chief commercial importance will be mentioned.

(1) San Josè Scale (*Aspediotus perniciosus*). This is one of the most injurious apple pests. The mature scale is gray in colour, circular and about the size of a pin-head. It may be controlled by spraying with lime sul-

phur. (2) The Codling Moth (*Carpocapsa pomonella*). It is of European origin, but is now found all over the world in the important apple regions. (3) Plum Curculio (*Conotrackellus nunaphar*). This insect attacks other fruits beside the plum. Curculios are snout beetles. They puncture the skin of the apple and feed on the pulp In addition, eggs are laid beneath the skin, and they hatch and live in the fruit for a while. The methods of control of this insect are (*i*) clean cultivation, and (*ii*) spraying with arsenate of lead.

Among the most important diseases of the apple may be mentioned the following: (1) The apple scab (*Venturia pomi*). This is a very destructive apple disease. It thrives especially in cool moist climates. This disease is caused by the fungus which lives on the leaves and fruits and to some extent, on the twigs, and in winter on the fallen leaves. Scab appears on the fruit as somewhat circular, dark-gray spots The size of individual spots varies from tiny specks to blotches half an inch in diameter. The fungus also attacks the leaves, causing the same discolouration common to its early stages on the apple. Most of the infections of the leaf are confined to the downy underside. The disease may be controlled by spraying with lime-sulphur in combination with lead or nicotine; and by burning all fallen leaves. (2) Bitter rot: (*Glomerella rufomaculans*). The fungus works in the tissue of the apple, causing at first small light brown spots just beneath the skin of the apples. These spots may increase rapidly in size. The disease is spread by spores, transmitted by rain, insects or birds. It may be controlled by the application of Bordeaux mixture. (3) Fire Blight (*Bacillus amylovorus*) is a serious disease of the apple as well as of the pear. The control methods consist in thoroughly removing all the diseased parts and disinfect them.

The subject of pruning and thinning is another very important phase in horticultural practise.

Pruning may be roughly defined as "the art and science of cutting away a portion of the plant to improve

its shape, to influence its fruitfulness, to improve the quality of the product or to repair damage".

The science of pruning consists in the understanding of the growing and fruiting habit of a tree, its relation to the bearing habit, the effect of pruning on the size of the tree, on the fruit spur and fruit-bud formation, its influence upon the size of the fruit and the effect of pruning at different seasons of the year. A discussion of this subject cannot be entered at length in this paper; but its principles with regard to the efficient production of the apple will only be briefly discussed.

The apple, together with the pear bear flowers terminally on short growths springing from terminal buds on spurs. These individual spurs only bear once a year as a rule. Maximum fruit-spur formation is encouraged by leaving the trees unpruned or by lightly pruning them. Usually, however, more spurs form than the tree can support to advantage. And since the spurs of the apple bear fruit repeatedly they should be retained as long as they are efficient producers. The object in pruning the apple tree is therefore to keep the fruiting spurs strong and vigorous.

As a general rule it may be said that pruning the apple tree should be more severe in the first few years. The next few years it should decrease in severity until the tree reaches the bearing age. When bearing age is reached the pruning is increased; but this should consist mainly in thinning out rather than cutting back a few large limbs.

All pruning practices are applied with the idea of developing the type of tree suited to the local conditions. Hence we have several types of pruning: (1, the natural form, (2) the central leader type, (3) the open centre or vase type, and (4) the double-headed type. All of these methods have both their advantages and disadvantages. It is, therefore, wise for the farmer to study the method used in the most productive orchards of the region before he should decide as to the method he is going to adopt.

As to the best time for pruning, no definite statement can be made. The time for pruning varies with different conditions. Winter pruning is however more resorted to than summer pruning.

Thinning (of fruit) may be defined as the removal of a portion of the crop of fruit from the trees, to prevent over-bearing.

The objects in thinning are: (1) to increase the size, colour, quality and uniformity of the fruit, (2) to prevent the breaking of the limbs, (3) to reduce disease and insect injury to the fruit, (4) to maintain the vigour of the tree, (5) to secure more regular bearing, and (6) to decrease the labour of handling the crop.

The apples are either removed by hand or by shears. The first method is more universally adopted. No exact rules for thinning can be formulated. A distance of 4 to 6 inches is common. But this also depends on the variety of the apple. For obtaining the best results thinning should be done while the apples are one inch or one inch and a half in diameter.

Another very important phase in apple-growing is the subject of pollination. Certain fruit varieties are completely self-fruitful, other are partly self-fruitful and still others are selfbarren. While in some cases, it is safe to plant solid blocks, in other cases it is found that there are many varieties that are benefited by cross-pollination. Some are self-unfruitful under any conditions. Although the flowers of the apple are true hermaphrodites, there are many varieties that are self-fruitful whereas some are selfunfruitful under any conditions. The degree of selffruitfulness, however, depends also on the age and vigour of the trees, the season, locality and many other factors.

So from a practical standpoint it is always better to have mixed plantings than a solid block of one variety, although the latter may be successful under some conditions.

(*Continued on page 30*)

THE PEASANT AND HIS PROBLEMS

By H. P. Srivastava

The basic problems of India relate to the peasantry and the industrial workers, and of the two the agrarian problem is by far the most important.

The problem of rural uplift is engaging the serious attention of our present-day leaders. The object of the movement is to raise the standard of life, cleanliness, and intelligence.

There is in the villages an appalling amount of misery and suffering due to ignorance, illiteracy and backwardness. Villagers all over India are now looking forward to the inauguration of a new era of prosperity and progress. They are interested in new processes of cultivation, in growing new varieties of crops and in the use of better seeds and implements. They also recognize the advantages of clean villages and are prepared to contribute their labour and practical help towards this end. Village life is beginning to be more attractive and happier.

But as they are ignorant of the way to be followed, lead should be given to encourage them. In this connection money is of value always but personal interest, sympathy and guidance, are of more value. Lead should be given in methods of administration, and of improving their economic condition. They should be told as to what their requirements are and how to achieve them.

The requirements of the peasant can be placed under five heads: administrative, economic, educational, social and those relating to health and sanitation.

I. **Administration:**—For the better administration of the villages, the establishment of *panchayats* is very necessary. If we turn over the pages of the ancient history of the Indian villages, we find that every village had an institution for self-government named the *panchayat*.

Everybody's interest was in the common good and this was responsible for the village prosperity under the *panchayat* system. Even today we see this *panchayat* system prevalent in many villages.

It is generally seen that most of the cases in the courts are filed by the villagers. The villagers spend much money in running to the courts for petty strifes. The villagers have to spend much money for the fees of the pleaders, *sepoyees*, *peshkars* and so many other middle-men. All this drain of money can be prevented if there are established *panchayats* in the villages. There is also a great deal of work for economic and social development and sanitation, which the *panchayats* can deal with.

Representatives from all the village activities should constitute the *panchayat*. Thus there should be ministers of discipline, sanitation, directors of agriculture and industries, finances and social organization. These ministers and directors should be qualified men and should be elected by the villagers themselves. The life of the *panchayat* shall be five years, and at the lapse of this period, fresh ministers and directors should be elected for the respective departments.

II. The **economic problems** of the villagers may be enumerated as follows:—

(*a*) Depression in trade.

(*b*) Want of suitable implements and tools for cultivation.

(*c*) Labour saving and cheap appliances.

(*d*) The problem of increasing the fertility of our soils by manuring.

(*e*) The problem of water storage for cattle and crops.

(*f*) The supply of suitable acclimatised seeds.

(*g*) The problem of cattle rearing and the manufacture of dairy products.

(*h*) Subsidiary industries during off-season.

(*i*) Monetary help.

(*a*) *Depression in trade.*—Due to the world-wide condition of supply and demand and partly due to our own unsystematized way of marketing, our agricultural produce has gone down. The villager does not know what the crops which are in great demand are. His geography is very much limited. He does not know where his produce goes and is contented in selling his produce soon after harvest, thus getting minimum return for his labour and energy.

Thus, this problem of marketing arrangement is equally important. There are, of course, Government Marketing Boards, but it is quite impossible for the Government to tackle with this big problem with little funds at their disposal.

There should be a village board for this purpose which may be under the *panchayat.* The village *panchayat* will collect the commodities and transport them at cheap rate to distant markets. It can know easily the market conditions, that is, how much the supply is, what is going to be the demand, and accordingly can do the marketing for the growers living far away from the main city.

The village board can start a co-operative store in which it can bring articles of daily necessities for the villagers, otherwise the villagers are put to great inconveniences. Generally, it is the case in the villages, where there are no shops, that the villager has to run 2 or 3 miles for a bottle of kerosine oil or matches or such other commodities of their daily needs. These inconveniences can be stopped by establishing a co-operative store in the village, which should be under the *panchayat.*

(*b*) *Want of suitable tools and implements for cultivation.*—Much improvement is needed in the existing tools and machinery of the village. They are quite inefficient. As for example, the *desi* plough does not do efficient ploughing. It simply scratches the ground and takes more time in ploughing an acre of land than the

improved ploughs, *e. g.*, the Wah Wah or Meston. The carpenters and blacksmiths have very limited supply of tools and implements to work with, and they do nothing about most of the modern implements. Consequently, they are not so efficient. These carpenters and blacksmiths should be sent to some neighbouring places for short periods of training in the theory and practice of improved implements and tools. The expenses should be borne by contributions from the village. The courses should be short, otherwise the carpenter or the blacksmith would be tempted to earn more and go to cities. He should not be allowed to go to the cities, if he has been trained at the public expense of the village.

(*c*) *Problem of increasing soil-fertility.*—This problem has engaged the attention of many of the agricultural experts of India, and it is one of the vital questions of rural uplift. The improvement of the country greatly depends upon the efficiency in soil management.

Of course, there are various factors which influence the increase of the fertility of the soil, manuring being the most important. The extensive use of manures means higher yield in the produce of the land and thus an additional profit to the farmer. But the farmers do not realize the benefit of manuring. They make fuel cakes from their cowdung. They do not know the manurial value of cowdung and other refuses from the barns. This farmyard manure is handled very improperly. The cowdung is left exposed to sun and rain and thus some of the important fertilizing constituents are removed by volatilization and leaching by rain.

There should be artificial latrines, and the villagers should use these, instead of squatting in open fields. Then the human excreta should be converted into manures by burning it in pits for 15 days.

Manure pits should be made and cowdung and other barnyard refuse should be made into compost. These pits might be thatched in order to guard the manure from sun and rain.

Pits may be made and given on rent to cattle owners, who should throw refuses and cowdung in them and thus prepare manure. Attempts should also be made to encourage the use of oil cakes, bonemeal, green manures, etc.

Literature in vernacular should be published and distributed among the villagers.

(d) The problem of water-storage for cattle and crops.—This is also a great problem facing the villagers. Sometimes when the rains fail, the water-storage tanks upon which the villager depends for water supply to irrigate his land and for the replenishing of his wells go dry. He does not have enough water even for domestic purposes during the dry season. As for his cattle, those poor famished patient animals so dear to his heart, and upon which he depends for his agricultural work, languish for want of drinking water, and drag their weary frame in front of him, as he despondently drives his plough often through fields thirsting for heavens to open out and shower down that much-longed-for and over-due rain upon its parched face. They, therefore, at times, have to send their cattle to other villages some three or four miles off to provide them with water.

This can be remedied by erecting bunds for the storage of rain water. Failing this two cement tanks for each village should be made which should be filled up by turns by each of the cultivator or for which money should be raised to give contract to a man for filling.

This problem can be easily tackled by forming co-operative society in the villages. It is out of the means of a cultivator to defray the expenses of building a well in a village where there is no well. In this the cultivators of the village may form a co-operative society. They should calculate the expenses for the wells necessary there, and then collect the sum from the villagers. Suppose there is a necessity of four wells, by which five hundred 'bighas' are to be irrigated and which require Rs. 2,000, that is Rs. 4 per 'bigha'. Now those who have

land to be irrigated should submit all the money required for so many 'bighas' of land at the rate of Rs. 4 per 'bigha.' If they cannot submit all the money at a time, then they should submit three-fourths or half or one-fourth of the amount required and the remainder they can submit in some years in instalments. Thus by the money collected from the cultivators, and the remainder from the government, they can make the required number of wells.

In canal areas the present system of progressive assessment in short duration should be immediately replaced either by 30 years lease without any increment or by increasing the duration of progressive assessment, because the present system of short duration does not give the necessary impetus to the villagers.

(*e*) *Supply of good acclimatized seeds.*—Our soil is capable of producing nearly double the present yield if improved methods of cultivation are adopted, and the quality of the produce can be greatly increased by the wise selection of seeds. Improved seeds give greater yield of better quality which fetch higher prices in the market. Want of confidence in the distributors is mostly responsible for the backwardness of the village as the villagers do not take advantage of the various suggestions made to them. Therefore, the distributors of seeds should be very careful about this.

The village *panchayat* can also take up the responsibility of distributing seeds to the cultivators, and can purchase the seeds from the government seed-stores.

(*f*) *Cattle-rearing and Dairy products.*—Agriculture in India depends upon the cow, as it is the cow that produces the motive power *i.e.* the bullock, the animal of all work. The day for tractor has not yet arrived in India. It is reckoned that about 90% of the population of India are dependent on agriculture, so that a great number are also dependent on a cow. Thus we see that this problem of cattle improvement is also one of the important problems of the day.

Bad breeding is the main cause of the deterioration in the Indian live-stock. This indiscriminate breeding is more or less common throughout India, especially in places where the cattle of all ages are let loose together, which is a general custom in the villages.

In this connection it should be explained to the villagers as to how valuable cattle may be acquired without great expense, and that good herds must be bred and not bought. The continued use of approved bulls, following the breeding process known as 'grading' is an economical and scientifically sound method of improving village cattle. But it must be borne in mind that cattle-breeding is a co-operative enterprise. There is very little chance of success for a man working alone. This work may be given to one department of the village *panchayat*. It may purchase a good pedigree bull for a herd of 50 cattle each, of a breed suitable to the environment. The bull or bulls may be maintained by the *panchayat* and it may charge a rupee or two for each service from the villagers. Stray bulls should also be castrated.

Then comes the problem of fodder for the village cattle. India is a country of two seasons: rainy and dry, and during the rainy season and for a couple of months afterwards the cattle get plenty of food and practically starve for the remaining seven months. So in order to get a regular supply of good green and succulent fodder we should encourage the making of silage. A part of the cultivated land should be reserved for fodder, or fodder cultivation should be included in crop rotations.

Dairy farming should also be encouraged among the villagers. The *panchayat* may form a co-operative milk station. First of all it should study the problem of supply and demand of milk. Then it should purchase milk from the *gwalas* and sell it in the nearest market. The profit should be distributed in proportion to the amount of milk supplied by the individual *gwala* or villager. The organization should be honorary, but labour and management may be paid.

The manufacture of dairy by-products, e. g., ghee, *dahi*, *mattha*, etc., should be encouraged.

(*g*) *Subsidiary occupation.*—Agriculture is not a profession that can keep an average cultivator engaged in his field every day throughout the year. Hence the introduction of some subsidiary occupation may help him out of his pecuniary difficulties. The following cottage industries can conveniently and profitably be taken up by the villagers:—

(*i*) *Rope making.*—Rope is made from the fibres of various plants. The villagers can grow sunnhemp in rotation and can make ropes from its fibres. They can make ropes from the fibres of linseed plant and *bhindi* also Generally, enormous quantities of *moonj* plants are found around the villages and the villagers can utilize them for making ropes.

(*ii*) *Toy making.*—Toys made of wood, paper and cardboard, etc. are in great demand. They can be bought at a very small cost, and toys made out of them may be sold at a profit.

(*iii*) *Mat making.*—Mats made from the leaves of palm or date palm trees or even of *moonj* are in great demand, both in the villages as well as in towns. The villagers can very easily get them and make a profit by selling them.

(*iv*) *Poultry keeping.*—This is a very profitable business and in foreign countries it is a very much advanced industry. The Mohammedans in the village can take up this industry and profit a lot by selling the eggs.

(*v*) *Bristles.*—These are used for brushes and needles. If the the low castes of the villages, *e. g.* the *chamar*, *mehtar* or *dusadh* keep a number of pigs, they will be provided with a fair quantity of bristles. Bristles cost Rs. 6 or Rs. 7 a seer; thus the man can profit a lot by selling them.

(*vi*) *Vegetable and Fruit culture.*—These two industries are also paying and at the same time they will raise the economic status of the people. These will keep the

villagers occupied during off-season and thus save them from useless gossips.

There are some other cottage industries also which can be taken up profitably *e. g.*, sewing, weaving, spinning, bee-keeping, basket-making, sericulture, lac culture, tanning, bamboo-work, pottery and wood-work, etc., and every cultivator should be induced to take up any of them.

This will be a source of recreation and a source of extra income also. Agriculture is a gamble with nature. A cultivator can never be sure of his success despite the fact that he has done all the field-operations at the right time and according to the dictate of Nature, as an attack of frost or hail-storm may damage his crops completely within a few hours. So, in order to safeguard against these uncontrollable calamities, it is all the more necessary to have cottage industries to get another source of income.

(*h*) *The monetary problem.*—This is the worst problem that confronts us. Every one curses the *bania* or the *mahajan*. But one should realize as to why the *mahajan* charges such a high rate of interest. The villagers, who borrow money, are very poor and have no security, and so the *mahajan* has to charge high rates of interest, as his capital itself may be lost.

If the *mahajan* stops lending money, the condition of the villagers will become still worse. They will die of starvation because the only occupation of the villagers is agriculture; and agriculture is such a kind of industry in which the farmer has to bear practically all the expenses of production before he gets anything from his crop. Moreover a man in some other industry can stop or lessen the manufacture of commodity while a farmer cannot, nor can he begin to manufacture when the market is good.

These are some of the reasons for the poverty of the villager. Moreover the villager when he gets money, does not know how to save. As for example, during the

Great War, when the prices of cereals or grains went up, the farmers made a lot of profit. But at that time these farmers, not only spent all the money they had, but also borrowed money on the hope that since their income had already increased they would be able to pay the dues the next year. At that time some spent extravagantly in marriage, some in *shradh*, some in making ornaments for their family and so on. Some of them spent a lot in running to courts. And in the end they were head over ears in debt.

The only way to help the villagers in their fiscal condition is the formation of Rural Co-operative Credit Societies and thus save them from the clutches of the *mahajan* who is said to be very exacting and whose interest is said to be exorbitant and consequently to save them from running into debts.

The society should be run on the principles of unlimited liability. Intelligence, thrift, honesty, confidence, self-help, mutual understanding, moral development, fellow-feeling and co-operation are the qualities necessary in the members to make the co-operative credit society a success.

These societies should lend money at a low rate of interest and only for productive purposes. The amount may be payable in easy instalments extending over a reasonable period. The profit of the society should go to swell the reserve. This will make it possible for the members to have cheaper credits which will enable them to make savings.

The loans if available at the right moment, will contribute much to the improvement of agriculture and considerably diminish their indebtedness.

"The one thing that has been proved over and over again is that short cuts lead nowhere, no matter how spectacular and sensational they may appear; discoveries periodically put forward as likely to revolutionize agriculture are often only the "stunts" of the hour."

SIR E. J. RUSSELL.

RUBBER TYRES FOR TRACTORS

For the last three seasons the Agricultural Institute has been experimenting with a tractor mounted on rubber tires. The experimenting has been in the nature of field use rather than of set short-time tests and has not yielded definite series of recorded data on power developed. It has given a considerable amount of experience which should be made available to other tractor users.

Our experience has confirmed that of others that the use of the tractor has been greatly facilitated by the freedom with which it can be taken to and from fields on all sorts of roads without having to put on road bands or remove the lugs. This makes it easy to bring in the tractor to the farmstead for servicing at night and for safety from tampering which often occurs when left in the field.

We have also confirmed the claims that fuel is saved and work speeded up. With steel wheels and lugs, we were rarely able to work in anything but the slowest speed with the implements we were using. With the rubber tires, we are able to use second speed most of the time and occasionally the top speed, resulting in much quicker covering of the area, often of great importance. We are using the same implements as before. The saving in fuel has not been determined exactly but has been substantial.

We had some difficulty when the tires were first fitted with lack of traction or slipping of the wheels, especially when the ground was a bit damp or there was grass. This was greatly improved by the addition of wheel weights but the difficulty was not entirely removed by wheel weights. On the suggestion of the Goodyear Tire and Rubber Company, the tires were partly filled with water to add weight. The tires were filled to approximately three-fourths of their capacity with ordinary water and then air added to the usual pressure.

We found this gave excellent results. Having the weight actually in the tire eliminated the spring effect of the tires so far as the weight was concerned and put the weight directly on the spot where it was most needed as dead weight. This not only increased traction but allowed the use of higher pressures which eliminated the slight trouble we had had on one or two occasions with the tires slipping on the rims. The use of water weighting is definitely much better than the use of wheel weights and so far no difficulty has been found.

M. V.

THE APPLE

(Continued from page 18)

In the selection of a pollenizer the following points should be considered: (1) For economical handling of the fruit, varieties should occur in plantings of at least two or three rows, (2) varieties should bloom at about the same time, (3) they must have an affinity for each other, (4) a pollenizer should be a good pollen-producer, (5) both should come into bearing at about the same age, (6) they should be commercial varieties.

In connection with pollination it is important to mention the fact that bees are the most useful agents in effecting cross-pollination. It is very important therefore to have several beehives in the orchard in order to insure pollination.

"Anyone who sets out to improve the practice of the good, modern farmer, undertakes a very serious task, and requires all the aid that modern science can give. Careful experimental work, though it may lead the experimenter nowhere, will somehow and at some time fit into its proper place for the advancement of agricultural science and practice."

SIR E. J. RUSSELL.

ADDING MOLASSES TO GREEN HAY PRODUCES PROTEIN-RICH SILAGE*

Using good alfalfa, more and more dairymen are getting better milk with this forage.

By F. W. Duffee

Haul new-mown alfalfa home fresh from the swath and make silage of it?

That idea has much to recommend it. No more shattered leaves ! No more damages from rain! No more waiting for good curing weather!

But wait a minute. Alfalfa silage has these advantages and some others as well, it is true, but there are complications. Alfalfa will not "keep" when it is just chopped and put into the silo, as many an experimenting farmer has learned.

One way to get around this difficulty is to add some molasses to the alfalfa as it passes through the ensilage cutter. The molasses ferments and forms acids that prevent decay-producing bacteria from attacking the alfalfa.

A Coming Winter Forage

Quite a number of progressive dairymen already are putting up molasses-alfalfa silage, and the number is growing every year. It looks as though the process may be well on the way toward popularity.

Before we discuss methods of putting up this new feed, let us first consider its advantages more carefully. It costs money to buy molasses, and applying it involves some extra work; consequently, a dairyman needs to decide whether in his particular case molasses-alfalfa silage will return enough benefits to offset its cost and

*An article borrowed from the Furrow, July—August, 1937.

leave a profit. Of course, molasses itself is a good feed, often being worth its cost for the extra nutrients it will add to the ration. But most farmers prefer to grow their own carbohydrate feeding materials; consequently, the use of molasses must be justified on other grounds if molasses-alfalfa silage is to come into common use.

Here is the merit of this forage that is rousing most interest at the present time : When fed to dairy cows, it results in production of milk that beats ordinary winter milk in quality. This milk is higher in vitamin A and growth-promoting power and, consequently, should be especially valuable for young children. Furthermore, it has a rich yellow colour that consumers like. Such milk should bring a premium on the market.

Makes a Protein-Rich Ration

Still another advantage of alfalfa silage is that it enables many dairymen to save on the amount of high-priced protein concentrates they must buy for their dairy rations. Because the new high-protein forage replaces part of the corn silage, it means that the roughage portion of the ration is unusually rich in protein.

In tests at the University of Wisconsin, molasses-alfalfa silage has brought about a good flow of milk in dairy cows. When fed at the rate of about 36 lbs. per head daily, along with 19 lbs. of corn silage, 5½ lbs. of alfalfa hay, and 10 lbs. of grain, it has resulted in a slightly better milk flow than a standard winter ration containing larger amounts of corn silage and alfalfa hay, and a grain ration of higher protein content.

In making alfalfa silage, good alfalfa must be used if the object is to produce superquality winter milk. Wisconsin trials with rank growing, stemmy, lodged, and molded alfalfa have shown that such forage, when made into silage, results in production of very ordinary winter milk. The whole secret of the molasses-silage process is that it helps to reserve the feeding value of

fresh green grass—but if the crop has already lost this quality on the field, then, of course, ensiling it will not bring the feeding value back.

USE GREEN ALFALFA

It is a good idea to cut the alfalfa to be used for silage in the early bloom state, or somewhat earlier than it would be for hay. Haul the alfalfa to the silo as quickly as possible after cutting, within an hour or two at the most. Hay that has been partly dried in the field generally makes poor silage.

There are a number of methods of applying the molasses. One that has been used rather widely in the past involves building an elevated platform near the ensilage cutter, and mounting on it a wooden or metal tank that will hold from two to four barrels. A barrel of molasses is poured into the tank, diluted with half a barrel of water, and then stirred thoroughly for half an hour.

A short piece of garden hose or pipe is attached to the bottom of the tank, conducting the diluted molasses to the blower of the ensilage cutter. The rate of flow can be regulated by a valve in the pipe or by a clamp on the house.

MOLASSES PUMP SAVES WORK

A much more convenient method of applying molasses has been made possible by a new pumping system recently designed at the University of Wisconsin. Undiluted molasses is taken direct from the barrel by a pump that is mounted on the ensilage cutter and driven by it. This does away with the need for an elevated platform, and makes it unnecessary to mix the molasses with water—which, on a cool morning when the molasses is thick, is no pleasant job.

A small rotary pump with inlet and outlet bored out to 1-inch size is suitable for this purpose. The

suction line consists of a 6-foot hose with an inside diameter of $1\frac{1}{2}$ inches, and a 30-inch piece of $1\frac{1}{4}$-inch pipe on the end to insert into the bunghole of the molasses barrel. The discharge line is a 1-inch hose equipped with a spreader nozzle made by drilling $\frac{1}{4}$-inch holes about 2 inches apart in a piece of pipe.

The molasses can be applied to the alfalfa in the feed table, just before it reaches the auxiliary feed roll. When this is done, care must be taken not to run the feed table empty, since when it does, the molasses will leak through to the ground. Some hay piled under the feed table will help to prevent waste, for the hay will catch any molasses that drips through, and it can later be fed through the cutter into the silo.

Be Careful of Clogging

If desired, the molasses can be applied farther back in the machine, between the last feed roll and the fan housing on flywheel cutters, or between the feed roll and cylinder housing on cylinder type cutters. This will work well if a steady supply of forage is kept going through the machine but, if the molasses pump is operated when the cutter is empty, it will cause molasses to accumulate in the blower housing and may bring about clogging when filling is resumed.

Applying molasses to the alfalfa in the cutter insures a very even distribution of the sweetening material. Every particle of chopped forage becomes coated with a thin film of molasses before it reaches the silo.

Two methods of regulating the flow have been used with the Wisconsin molasses pumping system. One is a hand-controlled, valved by-pass; the other is a shut-off valve in the discharge line, using an automatic by-pass. Both work well. The rate of flow must be checked and adjusted occasionally, because temperature changes influence the thickness of the molasses.

How Much Molasses per Ton?

Good alfalfa silage can be made using anywhere from 50 to 100 lbs. of molasses per ton of alfalfa, but 60 lbs. seems to be about the ideal amount. This is enough to preserve the alfalfa in fine shape, and it is more economical than using larger amounts.

On most farms, it will be found that the most satisfactory way to check the rate of flow is to mount the molasses barrel on a small platform scale and weigh it before and after a load of alfalfa is put through the cutter. A handier method is to install a molasses meter just above the pump, and then read the flow from that.

If neither a scale nor meter is available, it is still possible to check the rate of flow with fair accuracy. The first step is to determine the length of time needed to cut a ton of alfalfa. Next, multiply the number of minutes required to unload by three. This gives the number of seconds it should take to pump a one-quart measure full of molasses, and the rate of flow can be adjusted accordingly.

Sealing Silo Prevents Spoilage

After the silo has been filled, it is best to seal it until feeding is to begin. This can be done by covering the silage with tar paper and a layer of chopped straw or shavings about a foot deep. Soaking the straw or shavings with water will help to make an air-tight seal.

If alfalfa silage comes into common use, it will no doubt have far-reaching effects on farm practices. Dairymen will probably grow more alfalfa and less corn. On rolling lands, particularly, this would be desirable from the conservative standpoint, because alfalfa prevents soil erosion far better than corn. Then, too, alfalfa is generally the more efficient feed crop of the two, since under most conditions it produces more nutrients per cre,

SOY-BEAN MILK*

[*From the New York State College of Home Economics, Cornell University, Ithaca, N. Y.*]

1. Crack the beans and winnow the husk from them.

2. Measure, and soak overnight in enough water to cover. When fully soaked there should be a thin layer of water over the beans. This water does not count in measuring the water to make the milk.

*[NOTE: Lacking a native mill, we used two methods, both of which worked:

(*a*) Grind soaked beans twice through fine grinder of food chopper, then

(*i*) Press out milk in fruit press, or

(*ii*) Put beans in cheese cloth bag and knead by hand in bowl of hot water.]

3. The following morning measure the water into a kettle and heat. Six and one half or seven times as much water as beans should be used (preferably six and one-half). When the water is hot, begin grinding the beans.

4. Grind the soaked beans through the mill, gradually adding water from the kettle so as to wash down the oil which clings to the mill. Care should be taken not to add too much water at a time, or the beans will pass through without being ground properly.

5. When beans are all ground or pressed through the mill, add most of the remaining water and stir briskly into the milk to thoroughly mix the oil. Strain through cheese cloth to remove the bean pulp.

6. Put milk into the kettle with remaining water and boil 15 to 20 minutes. Stir after it starts boiling to keep from boiling over, and to keep the oil well distributed. The fire should not be too hot. *Do not stir to the bottom of the kettle.* Allow a scorched crust to form

*Supplied to us by The Agricultural Missions Foundation, Inc., New York.

in the bottom. This does not injure the milk nor give it a scorched flavour.

*(NOTE: With our equipment, this did not happen.)

7. Vessels containing the finished milk must be absolutely clean or the milk will curd quickly.

—Courtesy of Mrs. Bright, (North China).

SOY-BEAN MILK

(Formula from Peking Union Medical College.)

1. Half crack beans in any grain mill and remove skins.
2. Soak in water overnight—8 parts water to 1 of beans.
3. Grind through stones slowly, using all the beans and water.
4. Bring to boil and boil 20 minutes.
5. Strain through fine sieve.
6. Add calcium lactate and salt.

Courtesy of E. Laird.

TO MODIFY SOY-BEAN MILK FOR INFANT FEEDING

To 1 liter of soy-bean milk add 20 g. starch (rice or corn) and cook. Cool. Add 60 g. sugar, $1\frac{1}{2}$ g. calcium lactate and 1 g. table salt. The calcium lactate must be added to the cold mixture to avoid curdling.

Feed according to the child's caloric needs—about the same amount as of cow's milk. Do not use more than 1000-1100 c. c. per day. It may produce frequent stools.

Cod liver oil and some source of vitamin C (tomato juice, orange juice, etc.) should be given in addition.

*[NOTE:—We tried calcium carbonate, which adds three times as much calcium per gram of calcium salt, as the lactate. It is much less soluble than the lactate, but was held in suspension by the slightly thickened mixture. Dr. Stearns of Iowa has published a study which suggests that dicalcium phosphate may be a better choice. I want to try that another time.]

*(Notes by Miss Hauck of the New York State College of Home Economics, Ithaca, N. Y.)

Book Review

The Rothamsted Experimental Station Report, 1936, pp. 294. Price 2s-6d. *Obtainable from the Secretary.*

"The Annual Report of the Rothamsted Experimental Station fills a special place in the literature of science applied to agriculture. It reaches research workers in soil science and plant nutrition all over the world, and is of special interest to scientific workers, advisory officers and students in this country. It outlines the present position of the various investigations on soil and fertiliser problems conducted at the Station, and gives in full the yield figures for 1936 obtained from some 120 experiments carried out at Rothamsted, Woburn and numerous commercial farms in various parts of England.

An important section summarises the results obtained in experiments on soil cultivation during the last 11 years. Contrary to the widely accepted view the results obtained up to the present indicate that under the conditions prevailing at Rothamsted, yields are not greatly dependent on the particular cultivation methods used, so long as the work is done at the right time. These trials must be continued but the figures already available are worth careful study. A preliminary discussion of the effects of fallowing on the yields of wheat on Broadbalk Field brings out the striking difference of behaviour between the starved and the fully manured plots. When the yield is poor, fallowing produces a large increase in yield; in the presence of nitrogenous manures the effect is much less and may even be harmful in the first year following. The benefit due to fallow appears to be only of one-year duration as measured in the wheat crop. Experiments on the incorporation of raw straw with an accompanying dose of artificials show that handled in this way straw has so far produced much the same effect as dung or Adco Compost. Other sections of importance deal with experiments on dried poultry manure and the effect of fertilisers on sugar beet.

Long period surveys of the work of certain departments have been a feature of recent reports. This year the summaries deal with Field Experiments, Fermentation, Insecticides, and Entomology."

PITHORAGARH, ALMORA

NELLIE M. WEST

I heard of what the neighbours sixty miles away were doing and it added interest to an interest of long standing. I wrote them for particulars and then decided to do the same thing. So I began talking and within two weeks IT happened—a brand-new venture. I did not have a penny so we did it without pennies. I spoke to the district magistrate and he was enthusiastic for he too had heard of the neighbour's activities.

I had no idea how big to plan. Every time I spoke to a servant to create interest he seemed surprized that I should want to create interest, for it was already there. The day before the event I planned for vegetables and fruits this side, grain over there, flowers in this corner and pumpkins and cucumbers there. How many exhibits will there be? How much space shall I need? How many tables shall I supply? and dozens of other unanswerable questions came to my mind. I wanted display space enough and rather well filled but not crowded. How much space shall I provide? That question drummed monotonously all week.

The date was set for October 9th and the day arrived bright, fair, with a temperature of 70 degrees. Before I left my room I heard a half dozen servants on the veranda with their exhibits. Most of that day was spent, with short breaks, in writing names and pasting them on exhibits.

In the evening when we took account of the day there were people who had been interested enough to send one to thirteen things. They had come from twenty-six families or institutions, from thirteen places other than the mission. There were one hundred and seventy exhibits of about forty different things. Pumpkins, cucumber, rice, 'lauki' and flowers predominated. There were only a few specimens of each kinds of vegetable but a great variety of them. An estimated four hundred attended.

MONTHLY AGRICULTURAL REPORT FOR OCTOBER, 1937

I—Season.—Rainfall during the month was limited to Benares, Gorakhpur and Fyzabad divisions, where it was heavy in the first week and moderate in the second. Other districts received very light or practically no rains. The third week was rainless throughout the provinces.

II—Agricultural Operations.—Agricutural operations are generally up-to-date. Harvesting of *kharif*, picking of cotton, preparation of land for and sowing of *rabi* are in progress.

III—Standing crops, and IV—Prospects of the harvest.—Condition of standing crops is generally satisfactory and prospects favourable. The average outturn of cotton crop is estimated at about 75 per cent. of the normal.

V—Damage to crops.—Crops are reported to have suffered for want of rain in some districts. Damage to sugarcane by red rot and insects is reported from certain districts.

VI—Agricultural stock.—The condition of agricultural stock is satisfactory. Foot and mouth disease has increased but mortality is not high as indicated by the following figures furnished by the Director of Veterinary Services, United Provinces :

Disease	September, 1937 Seizures	Deaths	October, 1937 Seizures	Deaths
Rinder-pest ..	3,701	2,140	3,449	1,550
Foot and mouth ..	5,384	41	8,092	43
Haemorrhagic septicaemia.	1,798	1,475	485	407

VII—Pasturage and Fodder.—Fodder and water are sufficient everywhere except in Meerut, Muttra, Agra and Basti where fodder is reported to be scarce.

VIII—Trade and Prices.—The prices of the chief food grains have fallen except that of wheat. The following figures compare the average retail prices in rupees per maund at the end of the month with those of the preceding month.

			End of September, 1937	End of October, 1937
Wheat	..	..	3·481	3 527
Barley	..	..	2 658	2.352
Gram	..	..	3·433	2·401
Rice	..	..	4 315	4·175
Arhar Dal	..	..	4·785	4·751

IX—Health and labour in Rural areas.—Public health continues satisfactory. Cholera is reported from five districts and Smallpox and Plague from two only.

NOVEMBER, 1937

I—Season.—With the exception of some showers in the third week, which were too light to have any appreciable effect on crops, the month of November was practically rainless.

II—Agricultural Operations.—Agricultural operations are up-to-date. Harvesting of *kharif*, pressing of sugarcane, picking of cotton, and sowing and irrigation of *rabi* crops are in progress.

III—Standing Crops, and IV—Prospects of the Harvest.—The condition of standing crops is so far good and the prospects are satisfactory, though winter rains are needed in a number of districts. A statement showing the outturn of the various *kharif* crops, as estimated by District Officers, is enclosed.

V—Damage to Crops.—No serious damage to crops is reported except to sugarcane in Basti low lands which is reported to be seriously damaged by red rot. Red rot

is also responsible for damage in parts of Gonda, Gorakhpur and Kheri.

VI—Agricultural Stock—The condition of agricultural stock is satisfactory. Cattle diseases have further declined as is indicated by the following figures furnished by the Director of Veterinary Services, United Provinces.

Disease	October, 1937		November, 1937	
	Seizures	Deaths	Seizures	Deaths
Rinder-pest	3,449	1,550	1,398	769
Foot and mouth ..	8,092	43	2,513	27
Hæmorrhagic septicæmia ..	485	407	308	284

VII—Pasturage and Fodder.—Fodder and water are sufficient everywhere. Basti reports scarcity of fodder in flooded area only.

VIII—Trade and Prices.—The prices of barley and *arhar-dal* show a tendency to rise, others have fallen slightly. The following figures compare the average retail prices in rupees per maund at the end of the month with those of the preceding month :

	End of October, 1937	End of November, 1937
Wheat	3·527	3·441
Barley	2·352	2·688
Gram	2·401	2·375
Rice	4·175	4·048
Arhar-dal	4·751	5·076

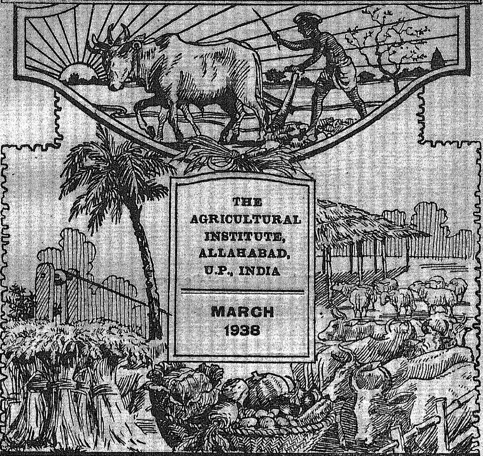
IX—Health and Labour in Rural Areas.—Public health continues satisfactory. Plague and Cholera still exist in certain districts.

P. B. Richards,
Director of Agriculture,
United Provinces.

VOL. XII] [No. 2

THE ALLAHABAD FARMER

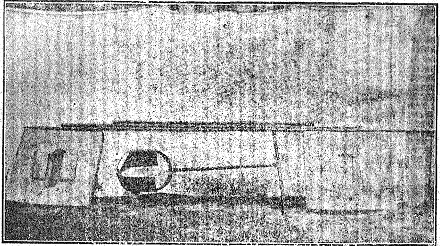
A bi-monthly Journal
OF
Agriculture and Rural Life



"There is no rural disability for which ignorance is the cure."

—General Armstrong,
Founder of the Hampton Institute.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility and sanitation, and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by 3½ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the shear broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & So s
(Signed) Jaswant Singh.

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE

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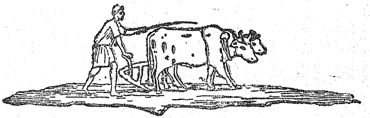

VOL. XII] MARCH, 1938 [No. 2

Editorials

The New Imperial Agricultural Research Institute.

When the Pusa Research Institute was damaged beyond repair by the earthquake of January 15, 1934, the Central Government decided to move the institution from Pusa in Bihar to Delhi, the capital of the country. When this move was proposed there was a great deal of misgiving in the minds of many people that the new location would not be a suitable place for higher research into the various subjects that pertain to agriculture. The Pusa Institute during its thirty years of existence had done a great deal not only to justify its existence but to make some people doubt whether better work along certain lines of agricultural endeavour could be done somewhere else in India. The notable contributions of Mr. (now Sir) Albert Howard, and Mrs. G. L. C. Howard, in crop studies, of Major J. W. Leather in the chemistry of soils and crops of India, of Professor Maxwell Lefroy in the field of entomology, and of Dr. C. A. Barber in the studies of sugar cane, were of so outstanding merit that it was difficult for some to think that such contributions can be made in Delhi, the capital of India.

However, the development of the new Research Institute at Delhi during the past year under the patronage of

the Viceroy seems to presage the increased usefulness of the institution in future years.

One direction in which the new Research Institute seems to be developing is in the training of agricultural research officers for the country. A development in this direction is most commendable, as at present there is no such central institution where high grade research officers can be trained. Most of such men are now being recruited from men trained in other countries, such as England or America. But these countries cannot be expected always to give the best sort of training for Indian students of agriculture, as the agricultural problems of those countries are usually different from those we have in India. It, therefore, sometimes takes much of the valuable time of a research officer to get acquainted with the problems that we have in this country.

Another very cogent reason for us wanting the Imperial Research Institute to strike out on this new line is because we believe that no one central Institute should try to solve the agricultural problems of the different regions of India. Delhi cannot expect to breed rice for the eastern provinces nor even wheat for the black cotton areas of India. Their problem, therefore, would be to teach the techniqne of tackling those problems which are variously met with in other parts of the country.

We would, therefore, like to see at an early date the establishment of regular courses of instruction for men properly qualified for such training and the affiliation of the Imperial Research Institute to a university which would grant higher degrees in agriculture to men who have successfully completed the training. Such degrees will encourage the more qualified and more ambitious young men of the country to join this noble band of agricultural workers who have not only ennobled the agricultural profession through their labours but who have also made very useful contributions to the betterment and welfare of the country.

Photo chemical Oxidation and Nitrate Formation in the Soil.

Recently a great deal of material was put out in this country in which the claim was made that the formation of nitrate in soil is mainly due to the chemical action of sunlight or to the periodic drying of soil, and not, as has usually been supposed, due to the action of certain biological agents. Since then, numerous researches have been carried out in different parts of the world, notably in America, in order to test this theory. The conclusions arrived at in other countries do not seem to support the above-mentioned theory. On the other hand, the results of these experiments seem to show that chemical processes can account for only a small part of the total nitrate produced in the soil, and that bacteria must still be considered as playing the predominant role in the process of nitrification under normal soil conditions.

TO BE THE BEST POSSIBLE TEACHER REQUIRES

Physical Vitality.—I will try to keep my body well and strong.

Mental Vigour.—I will study daily to keep my mind active and alert.

Moral Discrimination.—I will seek to know the right and to live in it.

Wholesome Personality.—I will cultivate in myself good-will, friendliness, poise, upright bearing and careful speech.

Helpfulness.—I will learn the art of helping others by doing helpful things daily in school and home.

Knowledge.—I will fill my mind with worthy thoughts by observing the beautiful world around me, by reading the best books, and by association with the best companions.

Leadership.—I will make my influence count on the side of right, avoiding habits that weaken and destroy.

—DOROTHY CANFIED FISHER.

(*In the journal of the National Education Association, U. S. A.*).

THE HAND THAT ROCKS THE CRADLE

BY F. L. BRAYNE

A little boy came crying home from school.
"Well, what's the matter, child?" His mother asked.
"I told a lie—I bit my nails—I don't
"Know what I did, but master said I was
"A dirty boy and beat me." "He beat you?"
"Yes, mother, and it's all your fault," he sobbed.
"You never told me not to lie or fight,
"Nor taught me to be clean." "Why should I, child?
"Who ever heard of mothers doing this?
"My job's to cook the food, to knead the dung,
"No job of mine to educate the young."

* * *

Dismissed for changing entries in a book,
A young clerk full of hate and rage came home.
"That's ruined everything," he said. "No chance
"Again of easy work; all father's efforts
"Wasted. It's your fault, mother, all your fault.
"You never taught me not to cheat. You brought
"Me up and should have told me all these things."
"No job of mine," his mother answered back,
"Who ever heard of mothers doing this?
"My job's to cook the food, to knead the dung,
"No job of mine to educate the young."

* * *

Condemned to death, a young man lay in jail,
Alone, a few more days of life to run.
His mother came to say a last good-bye.
"So that's the end," he said. "I know I struck
"The fatal blow. Just by mere accident
"I had my axe with me. A few hot words,
"I lost my temper and I lose my life.

"O mother! mother, you're to blame. It's all
"Because you never taught me as a child
"To keep my temper and control myself."
"No job of mine," his mother weeping said.
"Who ever heard of mothers doing this?
"My job's to cook the food, to knead the dung,
"No job of mine to educate the young."

* * *

The youth was silent for a moment. "Yes,"
He said at last, "You're right. You're not to blame,
"God knows you loved me, mother, gave your time,
"Your labour and would gladly give your life
"To help your children. No, it's not your fault.
'The fault lies higher; no one ever taught
"You as a child and never showed you how
"To bring up children when your turn should come,
"To use your love to train and not to spoil them.
"But tell my wife—she'll be a widow now
"Within a week—please tell her she must learn
"To bring our children up to speak the truth,
"To keep their tempers, to control themselves
"And to be clean in thought and word and deed."

* * *

There ends the tale. Is that the end for us?
Or shall we tell it up and down the land:
That love is not enough; instinct alone
Does not teach mother-craft. The sacred task
Of bringing little children up demands
That first the mothers shall be taught and trained.
Not else can India have good citizens.
Thus, only thus will peace come to our land,
The peace of happy homes, of empty jails,
The peace of mutual trust and honesty.

INJUDICIOUS USE OF WATER

BY CHAS. S. KNOWLTON

When a person leaves the locality in which he resides and goes into another part of his country, or into a foreign country, he will notice those things in which he is interested. As customs and methods vary in the different parts of the country and particularly in the foreign countries he will make comparisons. And not infrequently he will see methods in use that he will wish to copy and to take home and try to introduce. If he be interested in agriculture he probably will see as great a diversity of methods and practises as in any activity. There will be many methods of tilling the soil, of sowing and planting of seeds and trees, of harvesting the crops and their marketing. It is certain phases of the care and tilling of the soil and the growing of crops that will be discussed in this paper.

The writer was raised in California where much of the agriculture depends upon irrigation. He has been considerably interested in irrigation methods used in the different parts of California and other western American states. In some areas irrigation has been successfully carried on over a long period of years while in other areas where less satisfactory methods were used, and perhaps natural conditions less favourable, failure and loss have resulted.

It is quite generally true that where the supply of irrigating water is limited and its cost relatively high, irrigation has been successful for many years; while, on the other hand, where there has been a plentiful supply of cheap water there has been a serious, if not a total loss. And particularly this is true where inadequate or no drainage systems were installed. In practically every case where a so-called "reclamation project" was carried out in the western United States where they had an abundance of cheap water the soil became water-logged

within a few years and had to be abandoned. In a very few instances some of the people had foresight enough to install drainage systems before it was too late. In other cases after much of the land had been abandoned it has been successfully re-reclaimed by proper leaching and drainage methods and systems.

It happens that in the district where the writer has spent the most of his life, in most of the years there was a water shortage that was sometimes acute. The cost of irrigating at certain times of the year was much higher than at other times when gravity water was more plentiful and the use much less. It was quite the common thing to soak the soil thoroughly in the late spring, thereby thinking to anticipate the needs of the trees during the warm dry summers when there is no rainfal and the cost of water is high. But they found that many of the orchards had a very high percentage of sick or decadent trees. This condition seemed worse on the heavier types of soils and appeared to have a very direct relation both to the amount of water applied, and to the method of application. As the direct result of many studies of the problem two things were done. First, the method of applying the irrigation water to the soil was changed. A few years later it was proved that the time and amount of water applied was equally important. During the earlier years of irrigating citrus orchards practically all of the water was applied by what is called "flooding," that is there were ridges built up to form basins and these basins were so filled with water that the surface of the land was covered to a depth of several inches; with extra good farmers the deeper the better, but the shorter the life of the trees. And all too frequently the worse the trees looked the more water was applied. Then a few people began to irrigate in furrows, or small ditches run between the tree rows, no attempt being made to wet all of the surface at any one time. While this method was an apparent improvement over the old flooding method there was still the need for additional study. Then someone made the observation

that the trees made the greatest amount of root growth as the soil became drier and the trees approached the wilting point. Then the practise of saturating the soil thoroughly at the end of the spring rainy season was abandoned and until late summer but light applications of water were made. Then as the hot season neared and the use of water by the trees increased more water was applied at an irrigation. Some effects of too heavy applications of water will be discussed later in this article.

Soil tillage methods are inseparably involved with irrigation practices and methods. There has been in all history scarcely any exception to the rule that land that has been over-irrigated was also ploughed or cultivated when very much too wet. The idea was that by breaking up the surface of the soil evaporation would be prevented or retarded. But there were alway some people who did not cultivate as soon after an irrigation as was the common practice and it was noticed that their orchards did not decline to the same extent as did the orchards that were over-irrigated and cultivated too wet. Then considerable study was given to the effect on the soil of the timing of the cultivations.

It was noted that the soil that was cultivated or ploughed when quite wet did not produce the satisfactery crops that soil that was worked when much drier produced. When wet soil is stirred in any way and exposed to the hot sun, (bricks for example) it becomes "baked" and all of the humus is "burned" out. Many experiments were conducted in an attempt to learn the actual value of cultivation, if any. The final conclusion has been that cultivation, of itself, has no virtue. It is only done for certain specific reasons:—For the incorporation of fertilizers, the planting of crops, weed control and water control, either irrigation or rainfall. No amount of cultivation has any great effect upon evaporation, but it can and does have direct effect upon the physical condition of the soil, and indirectly on the ability of the trees to use the water. Aside from the baking of the surface soil and the entire loss of humus there will be formed, or

caused to be formed a plough sole, or plough pan, that will become perfectly impervious to water so that, while the surface of the soil may be saturated, the sub-soil can be perfectly dry. There was a time when it was thought beneficial to break up this plough sole by using sub-soil tools which broke up the soil to considerable depths. But they also cut and damaged a large portion of the tree root systems. Then it was learned that if the soils were worked only after they had dried out to a certain extent, no plough sole was formed. Also that when irrigation water was applied after drying out, there was much greater penetration and the entire surface of the soil was not saturated, the water being applied in furrows two feet or more apart.

It was at about this stage of the investigational studies that tractors began largely to replace horses as motive power for the soil-tillage operations. There was great rivalry between the wheeled type and the track-laying type of tractors. The latter people claimed that they could run upon wet soil without packing it as badly as the wheeled type of tractor. Then there was a question of the horse power of the tractor to do the work done by a given number of horses in a day. So some cheap but accurate dynamometers were used to test the relative merits of the different types of power. Quite disinterested university professors made the observation that when the various types of soils were permitted to dry to such an extent that the tilth was about ideal, the type of tractor made no difference. But the point that is pertinent to this paper is that in practically every case the ideal soil tilth condition and the lowest dynamometer readings exactly coincided. This means that cultivating soil either too wet or too dry consumes more power than when worked at the optimum moisture condition for good seedbed or orchard tilth. While great, or possible permanent damage can be done to most soils by working them too wet, no such damage will be done if they are worked too dry. Where open fields are ploughed when quite dry they will absorb greater amounts of rain, while if ploughed too wet there will be run-off.

Now for some observations and comparisons of Indian methods with those of California. The writer arrived in northern India early in April, 1937. In the hill districts they had what they said was an unusually wet spring. The soil was quite thoroughly saturated, in many places water standing upon the surface. He saw ploughing being done in actual mud. Not long after his arrival he made a trip into the Kangra Valley and all along the way saw soil being ploughed in what he thought a very much too wet condition. Upon inquiry as to why that was done he was told that ploughing was done while the soil was quite wet because it was much easier on the bullocks to pull the plough through the wet soil. Then a sort of drag, or smoother, was dragged over the ploughed soil and still further packed it. Then the seeds were sown or planted. At the very first indication of warm weather the crops began to show the need of irrigation. When water was applied it was made to cover the land entirely and sometimes kept on a day or two, regardless of the depth of penetration. Then the next day, or at most two days, after the water was turned off they were in with hoes chopping up the much too wet soil. There would be times when the crop had been allowed to reach the wilting point before water was applied and then the crop usually just gave up and quit.

Another observation was that practically all garden crops were sown broadcast instead of in rows. The question may be raised as to how that can be included in a paper on irrigation. When crops are seeded broadcast it will be necessary to flood irrigate, whereas, if they had been planted in rows they could be irrigated in furrows. With the rows spaced from 36 to 42 inches apart much less seed will be required and it will take much less water satisfactorily to irrigate the crop. Weed control, which is very important, can be very much more easily and efficiently done. A given area of land can only satisfactorily produce a certain amount of any given crop. If the plants are crowded too closely they cannot develop to their natural maximum size, or possibly pro-

duce the desired first quality of product. It is almost a certainty that if the seed be planted in rows and not to exceed one-third or one-fourth the number of plants per given area be permitted to grow, both the quality and quantity will be greatly improved. The planting costs will be less, the cultural costs will be less, the harvesting costs will be less and the profits should be greatly increased. So much for field crops.

As to fruit trees, nearly all the fruit trees have been planted very much too deep and where water has been available have been very much over-watered, sometimes at considerable expense. Pruning and other practices have no place in such an article, but are of great importance. But in practically every case that has been observed the soil has been worked when much too wet. The combination of too much water and the working of the soil too wet is more than most crops can stand and develop to get the maximum possible return.

It is a quite well-known fact that in order for most plants and trees to be healthy and to make a satisfactory growth, the roots must have a certain amount of oxygen. This is obtained from the air in the soil. If the surface of the land be entirely covered with water for any considerable length of time all of the air will be expelled from the soil and replaced by water. Then when the water begins to leave the soil the first replacement of gas is by carbon dioxide, which is toxic to most plant roots. Thus, when the soil is fully saturated the lack of oxygen will be detrimental to the plants and the replacement by carbon dioxide will be injurious. If the land can be so irrigated, as in furrows, that only a portion of the air is expelled, much better results will be had. And if a minimum amount of cultivation be done only when the soil has dried to the proper condition, much healthier plants can be raised and a greater profit realized.

The rate of penetration is important and can be very easily determined by pressing a small steel rod into a

(Continued on page 58)

A Book Review*

By Dr. Sam Higginbottom

Indian Agricultural Economics By A. D. Patel, M. A.—
D. B. Taraporevala, Sons and Co., Bombay—Rs. 6

This book is put out in a satisfactory manner. The printing, binding and paper are good. It is a pity the subject matter does not match the printer's work.

Hope springs eternal in my breast that some day there will be published a book on Indian agricultural economics that will do justice to the subject. This book fails to satisfy. The title is misleading. The book covers only part of the Borsad Taluka of the Bombay Presidency. A few all-India tables scattered throughout the book do not give it the all-India character its author would like it to be considered to have. Nor can one by any stretch of the imagination make it fit into all-India conditions. Local vernacular terms are used and are not explained or defined, if at all, until many pages after they have been introduced so that the reader is confused, until finally he comes upon something which partially explains the terms, and he then has to go back to get the author's meaning. The *bigha* is used as the measure for land. It is not defined until about half way through the book, and even then is not so clearly defined as to enable one to use it for purposes of comparison.

Crops and types of soil have both English and scientific names. In a book written for English knowing people it would be well to use such terms. I never saw before the terms, *goradu*, *kodra*, *bavto*. They are not used in this part of India. English and scientific terms would clear the matter. There are certain passages that seem to do violence to logic, as on page 30, "If continually cropped, a land loses much its 'original and indestructible' power through loss of nitrogen." If the power of the soil is indestructible how can it be lost?

*The article was originally written for publication in The Leader.

Again nitrogen is the most easily lost of all the elements of plant food and can be restored easily by applying manure, or chemical fertilizers or by growing legumes.

Again he suggests that nitrogen is restored by the rotation of crops, specially of root crops. This is difficult to agree to. It is difficult to get what is meant. On page 31 regarding *goradu* soil: "It is difficult to work in this soil as the constitutent particles of clay are cohering and more porous than of the sandy soil." Again on page 54 this soil is said to be "pervious".

Page 37: "The temperature never falls below 55 deg. F." Yet on page 38 he gives a table in which the January temperature is given as 52 deg. F. in 1933, then goes on to say that during 1933-34. and 1934-35 frosts ruined the tobacco and *tuer* (*tuar* ?) crops. How then can these statements be reconciled? They certainly do not agree. He falls into the common tautological error of "very essential". If "essential" why "very"? Proper names are not accurately copied. Widtsoe is given as "Wistoe" on page 41. The idiom is not always correctly used. Page 45: "not sufficiently provided with regular channels to carry *out* the surplus water," to carry "off" or "away" is more common. On page 52, "Sea face" for "Sea level."

Many things the student of agricultural economics wants to know are not given definitely, *e.g.* on page 49 and 50, the depth of the wells is not given. Without this important fact it is difficult to come to a right judgment. Again on page 54, "A *juwar* (*jowar*) which is . . . . . 350 bundles on dry land per *bigha* is 600 bundles under irrigation." How large is a *bigha*, and what is the weight of, and how large, is a "bundle"?

On page 57, "sheer" is evidently written for "seer". On page 58, it is almost impossible to follow what he means when he writes of the operations involved in sinking a well. On page 1[illegible]3 he speaks of the "sheep" as the poor man's cow and gives the authority as page 180 of the report of the Royal Commission on Agriculture,

Reference to the report fails to reveal the statement. I wonder whether "sheep" is not a slip of the mind for "goat"? On page 105 we are told that: "Churns the curd into ghee". I do not know how this is possible.

Again his accounts with a buffalo are incomplete, and will not stand analysis. Nothing is included for stabling or the three months dry period. Anyone who took his statements as a reliable guide to buffalo or cow keeping would experience great difficulty and most likely serious loss. On page 1(8 he states: "It is not possible to determine how much work a pair of bullocks can do without injury to their health and efficiency". He then goes on to do the very thing he says is impossible.

On page 109 he speaks of the "Hundal" system. What is it? Page 113 "Cotton seeds . . . . . has proved of immense value in increasing the quality and quantity of milk". This statement is incorrect. The quality of milk, and the capacity to give milk are both inherited characters and therefore the feed has little to do with the change of either. No known method of feeding a cow with an inherited capacity to give four pounds of milk a day will cause it to give more. A cow with an inheritance allowing it to give a certain amount of milk may be so underfed that she cannot yield milk up to her inheritance. Better feeding will enable such a cow to give more milk, but no amount of better feeding will cause her to go beyond her inherited amount.

The author also says there is enormous profit to be made out of cattle betterment. This will be welcome news to those who have been engaged in cattle betterment and so far have found it an expensive business.

What is one to make of the following sentence? "The buffalo is an important source of income as it is a milch cattle".

Page 116: "Iron ores are also imported from the outside and are shaped according to requirements." Again tautology. How would anyone shape iron ore, and after it was shaped what would he do with it on a farm?

His descriptions of agricutural implements are unnecessarily long, involved and inaccurate. One who did not know what the author was writing about could not construct a tocl from the description written.

I have written enough to show that the book is unsuitable for students, and less so for anyone wanting to learn anything definite and accurate about Indian agricultural economics. The author quotes with approval Voelkar (the name is again wrongly spelt). There is no question that when it was published Voelker's report was the best thing of its kind that had come out. But agricultural science has made great progress since Voelker's day. The student wants something modern.

There are a few interesting things mentioned as for instance that there is not much land left out of cultivation for grazing, that the custom is to have fences of growing bushes and near them strips left in grass; that this system provides fuel wood for the villagers and more fodder for the cattle than more land left specifically for grazing. This is correct. If this practice could be extended it would help greatly. He also notes that even before the advent of the British, all was not well with the Indian farmer, for on page 71, he declares that the Marathas had a ruinous land revenue system. He also notes that some social customs are not good: as dowry, death feasts, *purdah*. He would gradually do away with caste.

The author states there is improvement of late years in the Dharala caste, but they still are thriftless, improvident, too lazy to work, and waste their time and money on gambling. Evidently it is too soon to reduce efforts for further improvement. He also notes that the untouchables are industrious and hardworking but suffer from forced labour inflicted by the higher castes. He also records no qualifications to his praise of the joint family system, and sees no objection to it. In general the present farm implements and tools are good enough. He sees no necessity for introducing more modern tools and imple-

ments, while those who think that the only hope for a higher standard of living for the Indian villager lies in increased production, regard improved implements as fundamental. There is one exception however, oil engines and pumps irrigate from wells at about one third the cost of using oxen and save much time. He is in favour of the extension of engine-driven pumps.

It is with great reluctance and regret that I write as I do concerning this book. I wish the author had given us a book that would meet the needs of Indian students of today. I begin to question whether any person without training and experience in modern scientific agriculture as well as a thorough grounding in elementary economics and sociology is wise to attempt such an ambitious task as a book covering the whole field of Indian agricultural economics. There are so many pit-falls and traps for the unwary and ill-equipped writer as to make it seem as though success would not be secured. As a thesis written for an M. A. degree in economics by one with a slight, amateurish, and literary acquaintance with farming, the book is to be commended. It represents much work of compilation. But as a serious treatise on the subject matter described by the title it will not do.

INJUDICIOUS USE OF WATER

(Continued from page 53)

a furrow and noting the depth at which it stops when reaching dry soil. Then at a given interval say half an hour or so, another measurement is made close by and the difference will be the rate of penetration. And no more water should be applied than will penetrate to the depth of the root system of the plants being irrigated. More than that amount is what causes most of the trouble.

Sufficient water can be one of the greatest blessings that any land can have. But cheap water may be one of its greatest curses.

THE PROBLEM OF STORING SEEDS AND METHODS OF TESTING THEM

By B. M. Pugh and H. H. Misra

The proper storing of seeds is one of the most important problems which a farmer has to face. The loss in storage for seed purposes from the end of one season to the beginning of the next is enormous. In the case of potatoes, for instance, the loss in storage in the plains of India may vary from 40 to 90 per cent. and at times even more than this. The loss of grains due to storage may not be as great as this, but it may vary from 5 to 35 per cent.

The farmers of this country therefore have adopted various ways of storing grain and other crop seeds, but the methods adopted are so crude and inefficient that it seems very urgent that the proper storing of seeds should be evolved in order to avoid this great loss of seed during storage.

For storing grains the farmers commonly use mud bins which are known as *khuttis* when dug in the ground or *kothis* when above ground. Sometimes earthen jars (*bharolas*) and bags are also used for storing grain which is to be used in the home.

When stored in this way the grain is subject to the attack of various insects; and the loss caused by these stored grain pests is sometimes tremendous. One of the most common of such insects is known as the rice weevil (*Calandra oryzae.*) This is a small dark-coloured insect possessing a snout, thus resembling a small elephant, about one-eighth of an inch in length. Each female of this insect is known to produce as many as 400 eggs which are laid on the grain. The eggs are hatched in about 6 or 7 days and the young insect then bores into the grain and eats out a large portion of it forming a hole in which it lies.

Another very common insect pest of stored grain is known as *khapra* (*Trogoderma khapra*). This is a

small active brownish-black beetle, the female of which lays 35 to 60 eggs which hatch in about 5 to 7 days. The beetle itself is harmless, but the grubs feed on the grain. These grubs are very active but are usually confined to the upper layer of the infected grain heap and therefore cause the greatest damage in the top 6 to 12 inch layer.

These two insects are known to attack wheat, rice and barley grains, although the last is more free from insect attack than the wheat grains.

Several methods of controlling these insects have been devised, but the one most commonly adopted is the use of carbon bisulphide at a proper strength for a definite period. Grains exposed to the fumes of carbon bisulphide at the rate of one ounce per 15 cubic feet of space for 24 hours will be free from all insects. The grain thus treated should be removed in order to allow the fumes to evaporate and the grains can again be stored. Care should be taken that no fire is brought near it.

Besides this problem of insect attack, stored seed has several other physiological problems connected with it. One should bear in mind that a seed is a living thing, although in a very dormant condition. It therefore requires all the essential things for the maintenance of life, except food which it has in store. Out of the elements required the most important is air for its respiration although the quantity may be infinitesimal as compared to that for other living plants. A time factor also enters in the deterioration of the protoplasm of the seed, and if healthy seeds are stored for a very long time they lose the power to function, even if they be free from any other cause of degeneration. It has been found that while some seeds function after a very long time, the seeds of most cereals and farm crops do not keep their viability much longer than one or two years. Even for such a short period the different methods of storing seeds make a a great deal of difference in quality.

Some of the conditions which are necessary for the proper storing of seeds are the following:—

1. Maturity of the seed. The grains should be quite mature before they are harvested to be kept for seed purposes. Immature seeds are not suitable for storage especially if the conditions of humidity and temperature are somewhat unfavourable to the dormant seed.

2. The seed should be fairly dry at the time of storing. This condition is especially important in the case of maize as the seeds of this crop deteriorate very rapidly during the process of storage if they are not properly dried.

3. The room where grains are stored should be fairly dry. High humidity is unfavourable to such seeds as maize, wheat, and barley.

4. The temperature of the room should be fairly low. At high temperatures especially under humid conditions the embryo of certain seeds may be killed. At any rate their viability is impaired. In the case of potatoes especially this is a very important factor, as potatoes degenerate very rapidly at high temperatures. In fact this is a factor which renders the storage of potatoes in the plains almost impossible.

5. Good air circulation is another factor which is necessary for the proper storing of most seeds. Maize more particularly requires a proper air circulation during the process of storage.

Now, as seeds used for sowing purposes generally come from different sources where they have been stored in various ways, it is but natural to expect that the viability of seeds will not always be the same. And as the germination of seeds is partly dependent on their viability, the stand of a crop in a field will greatly depend on their viability.

Twelve different tests made at the seed laboratory at the Allahabad Agricultural Institute with wheat seeds obtained from four different sources gave the following results:

1. From wheat stored in barrels, 91·0 per cent.

2. From wheat obtained from a depth of one foot from the top of the bin, 90·3 per cent.

3. From wheat stored in gunny bags, 88·5 per cent.

4. From wheat obtained from the top of the bin, 83·6 per cent.

Other tests were made with gram, barley, *berra* (a combination of gram and barley) with the following results:

	From top of bin	From middle of the bin
Gram ..	66·0 per cent ..	70·5 per cent.
Barley ..	72·0 per cent ..	82·0 per cent.
Berra ..	71·5 per cent ..	94·5 per cent.

These results indicate that the same seed rate cannot be applied to seeds obtained from different sources. And as the yield of a crop greatly depends upon the optimum number of plants in the field and as the profit from a crop may be increased by sowing neither too little nor too much of the seed at any one time, the proper seed rate for each crop seems to be a very desirable factor in the profitable production of crops. The Agronomy Department of the Allahabad Agricultural Institute is now engaged in also finding out the proper seed rate for various crops under field conditions. It has been found also that the the germination capacity of various strains or varieties of a crop are not always the same. Tests made at this seed laboratory show that the Kabuli gram has a germinating capacity of only 37·5 per cent, whereas Pusa type 17 gram has a 55·5 per cent. germination and the local gram gave a germination varying from 66 to 70·5 per cent.

A more properly designed experiment in which Fisher's statistical analysis of the data was used was carried on in connection with barley seeds obtained from a bin 10 feet long by 3 feet wide and 5 feet deep. Three

samples of seeds were taken, (1) from the top of the bin, (2) from the centre of the bin, and (3) from the bottom of the bin. The experiment was carried out in order to find out the factors which are responsible for the deterioration of the seeds. The data were analysed and the following is the result of the analysis :

Due to	D.F.	S. S.	Mean Square	Z	Significance	Standard Error
Treatments	2	827	413·5	1·745	Very highly significant.	2·9 per cent.
Error ..	24	303	12·6			

Sources of Seeds	Centre of bin	Bottom of bin	Top of bin	Significant difference
Number germinated	421	358	299	30

The various factors that are responsible for these differences seem to be the following: (1) the attack of stored grain pests on the seeds on the top of the bin, (2) temperature, and (3) the effect of air circulation, that is, air seems to be a limiting factor in the case of the seed at the bottom of the bin. These factors seem to show that a depth of 5 feet for storing seed has a deteriorating effect on the germination capacity of the seed.

Other investigations are being carried on in connection with the germination of seeds and their storage and it is hoped that the data will throw more light on the problem of storing seeds in the plains of India.

In connection with seed testing the Institute has also used severel methods such as (1) the rag doll method, (2) the use of saw dust, (3) the use of field soil, and (4) the use of ordinary sand.

The rag doll method simply consists in putting seeds in a moist cloth. The seeds are properly arranged, generally in small squares marked out in the cloth which is then rolled carefully and fastened at both ends, care being taken that the seeds should not move out of their

positions. The cloth is then moistened with water and kept in a fairly warm room for a few days until the seeds have fully germinated. The cloth is then unfastened and unrolled carefully on a table, thus exposing the seeds. The number of seeds which germinated are counted and the percentage of seeds germinated is then found out.

The other three methods are all similar. The methods simply consist in putting the seeds on top of an earthen dish filled with saw dust, ordinary soil or sand. The seeds are then thinly covered with the same material. Enough water is then added to just moisten it. The dish is then covered with another one of the same size. The seeds that germinate are counted at the end of the germination period and the percentage of germination is then calculated.

In place of saw dust, soil or sand, several layers of ordinary blotting paper may be used instead. This process also gives fairly satisfactory results. Experiments conducted with different materials for seed germination seem to show that better results are obtained by the use of ordinary sand. But sand once used should not be used again unless it had been exposed to the sun for several days, as this helps to kill all the fungi and other organisms that may have been left from the previous seeds and which may have injurious effects on the germinating seeds.

THE PROBLEM OF AGRICULTURISTS' DEBTS IN INDIA

The problem of agriculturists' debts, and their redemption from the burden, is one of those pressing questions which demand the earliest possible attempts at solution. The volume of agriculturists' debt is variously estimated at between 800 to 1,200 crores of rupees—equal to the entire year's produce of new material wealth in this country at present prices.—*By K. T. Shah in* HARIJAN, September 11, 1937.

LIFE IN THE SOIL

BY S. CHOWDHURY

It is customary to regard the soil as if it were a dead matrix of smaller or larger pieces of rock, such as sand, gravel and stones, and organic remains such as bits of wood, leaves, and bones, with water and air in their interstices. As a matter of fact, however, a vast number of organisms, animal and vegetable, live in the soil. By far the greater part of these belong to plant life and these comprise the forms of greatest influence in producing the changes in structure and composition that contribute to soil productiveness. Most of these organisms are very minute and can be seen only with the aid of the microscope. The organisms which concern themselves greatly with the fertility of the soil are the algæ, actinomycetes, bacteria and fungi. A very brief account will be given here of their role in the soil.

Algae.—The soil is a favourable medium for the growth of algæ and a large number of algæ are found in the soil. It is impossible to generalise concerning the role that algæ may play in soil processes. Although it seems to be definitely established that algæ are unable to fix atmospheric nitrogen, they may be able to do so by living symbiotically with nitrogen-fixing bacteria. They may also accumulate organic matter in the soil but since they need available nitrogen, they may compete with higher plants for tho soluble minerals and available nitrogen compounds in the soil. Algæ have been found to convert ammonia nitrogen into organic nitrogen. The probable role of algæ may be said to consist in accumulating organic matter in newly formed soils. It has been suggested that algæ by taking in carbon dioxide and giving off oxygen make swamp soils suitable for the growth of the rice plant. The roots of rice plants are typical land roots and possess no special adaptations to growth under swamp conditions. The large supply of dissolved oxygen

in the swamp water produced by the photosynthetic activity of the algæ enable the rice plants to grow under these artificial conditions. The fact that algæ are present in the soil in considerable numbers, that they can grow even in the sub-soil and in the dark, that they retain their vitality for very long periods, even after prolonged droughts, that they can store large quantities of energy thus making them available for other organisms, all point to their probable importance in the soil. The algæ also exert a solvent action upon insoluble calcareous materials. In this respect algæ together with certain autotrophic bacteria play an important role in the disintegration of rocks and in the formation of soils.

Actinomycetes.—These are mould-like fungi characterised by extremely fine mycelium (usually less than one micron in diameter) which is normally non-septate and either lacks nuclei or possesses nuclei too minute to be resolved by the microscope. They reproduce by conidia formed in chains at the tips of aerial hyphae and in many cases also by a fragmentation of the mycelium into segments very analogous to those of the higher fungi.

The actinomycetes are an important group of organisms; a large number of them live saprophytically in the soil and play an important part in the circulation of organic matter in the soil. They take an active part in the decomposition of organic matter in the soil, both of a nitrogenous and non-nitrogenous nature. Some species are capable of decomposing celluloses very rapidly. Mace pointed out that actinomycetes decompose proteins into amino-acids and ammonia; he suggested that they may bring about the formation of humus in the soil. Active protein decomposition by actinomycetes has also been recorded by Fousek, Munter and Waksman.

The accumulation of humus in the soil is an index of the great resistance of this group of organic substances to decomposition by micro-organisms. Since this substance contains the larger part of the soil nitrogen, its decomposition is of great importance to soil fertility.

Actinomycetes seem to be among the very few organisms capable of attacking this resistant material and bringing about its decomposition. Liming of soil and draining of swampy soil favours the development of actinomycetes and also the decomposition of the soil organic matter. According to Fousek an increase in plant growth is obtained by adding actinomycetes mycelium to soil due to the increased decomposition of the organic matter thus brought about.

Fungi: Of the various genera of fungi found in the soil, the most common, both in number and in frequency of occurrence are *Zygorhynchus*, *Penicillium*, *Trichoderma*, *Fusarium*, *Mucor*, *Aspergillus* and *Rhizopus*. Fungi are not limited in the soil to any particular depth, but occur at all depths, at least to a depth of four feet or more even in soils in humid regions. The numbers usually drop below the surface (upper 6″) but in the subsoil there does not seem to be a rapid diminution with greater depth. The distribution of fungi in the soil is believed to depend upon the amount of moisture and the character of the soil.

The fungi in the soil take part in at least two important processes—rapid decomposition of complex organic substances and assimilation of soluble inorganic nitrogen compounds and minerals, especially in the presence of available energy, thus removing them temporarily from the soil solution.

Koning first suggested that fungi play an important role in the soil in decomposing the organic matter and in transforming it into humus. The decomposition of celluloses and of allied compounds in the soil by fungi is of great importance in soil fertlilty. This accounts for the abundance of fungi in soils rich in organic matter and for the great increase in numbers when stable manures and green manures are added to the soil.

Fungi also play an important role in the decomposition of organic nitrogenous compounds. In the presence of available carbohydrates the fungi utilise the nitrogen

compounds only as sources of nitrogen; in the complete or relative absence of available carbohydrates, they utilise the nitrogenous substances as sources of carbon and of nitrogen. In general, fungi play an important part in the mineralisation of the organic matter, whereby the nitrogen compounds and minerals are liberated in inorganic forms.

The decomposition of proteins with the formation of amino-acids and ammonia has been pointed out by Kosyachenko and others, Cyanamide is decomposed with the formation of ammonia as are urea, uric acid and glycocoll. According to McLean and Wilson filamentous fungi are capable of producing a greater accumulation of ammonia from proteins than bacteria. All the organisms studied including representatives of the families of *Mucoraceae*, *Aspergillaceae*, *Moniliaceae* and *Dematiaceae*, were found to be capable of producing ammonia from dried blood and from cottenseed meal. The *Moniliaceae* were most active. In 8 to 10 days *Trichoderma koningi* liberated as ammonia over half of the nitrogen in dried blood. The *Aspergillaceae* formed the least amounts of ammonia from proteins. The addition of soluble phosphate stimulated in most cases the amount of ammonia accumulated.

Various claims have been put forth at different times that fungi are able to assimilate atmospheric nitrogen. In most cases the quantities fixed were very small. In some cases the mere fact that fungi grew on *agar* free from nitrogen compounds was taken as an index of positive nitrogen-fixation. The more careful studies of recent investigators have definitely established the fact that common soil fungi are unable to fix atmospheric nitrogen. The only possible exceptions may be in the case of certain mycorrhiza fungi where positive nitrogen fixation has been demonstrated.

Bacteria: Bacteria have a part in many of the processes of the soil which greatly affect its productiveness. They are concerned with the decomposition of

cellulose and with the cleavage and fermentation of sugars, starches and gums. They probably also help in the decomposition of fats and waxes found in vegetable humus. Certain bacteria also decompose some of the mineral matter of the soil and render it more easily available to the plant. It is well known that several forms of bacteria are instrumental in decomposing rock, and that sulphur and iron compounds are acted upon by other forms. Some very significant experiments were performed by Stoklasa, Duchacek and Pitra, who found that bone-meal when brought into contact with pure cultures of certain bacteria was apparently rendered soluble, the extent to which the solubility progressed varying with the different forms of bacteria brought into contact with it. Various groups of sulphur bacteria through the production of hydrogen sulphide and sulphuric acid, act on iron in the soil and convert it into sulphide and sulphate. But one of the most important functions of bacteria in the soil is the transformation of protein substances in several consecutive steps, into ammonia, nitrites and nitrates.

Certain species of bacteria, among them *Bacillus mycoides* are able to secrete enzymes which aid in breaking proteins into various cleavage products such as peptones, amino-acids, carbon dioxide and ammonia. It has been established that certain other bacteria are able to oxidise ammonia to nitrites. These bacteria are designated nitrous or nitrite bacteria. Still other forms known as nitric or nitrate bacteria have the ability to carry the oxidation a step further and form nitrates which are immediately available as raw food materials for plant growth.

There are again two types of bacteria which are able to fix atmospheric nitrogen in a form available as plant food material. Certain forms are symbiotic, as the well known nodule-forming species on leguminous plants; other forms are known to live in the soil free and able to fix free nitrogen from the air.

THE PEASANT AND HIS PROBLEMS

By H. P. Srivastava

(Continued from the previous issue.)

"No problem can be solved till education filters down to the masses who are the backbone—the mainstay of the masses."

S. C. Mitter

III. Education:—In the previous issue I dealt with the administrative and the economic problems of the peasant. Now comes the educational problem and this is the most intricate one.

Education has been defined by some one "as the development of both mind and body, so as to enable a man to do well what he has to do".

The importance of education to the peasants may obviously be understood by the saying that, "Illiteracy aggravates indebtedness, promotes improvidence and extravagance, impedes the progress of agriculture, and what is more serious than anything else prevents that mass awakening without which no reform can be permanent". When a population is uneducated it is not progressive but stagnant. Its standard of living is low and has no tendency to rise. And this is true in India. Universal mass education, so necessary for the country's emancipation, has not yet been properly attempted. In the population aged five years and above in British India only ten out of hundred persons are literate. Only five children out of every hundred of the population attend educational institutions.

Thus we see that the provision made for education is meagre and that for adult education is insignificant. It is not with a high level of culture for few, but by mass culture (the average education of the common people) that the country will prosper.

But it is very difficult for the government, with its limited sources of revenue, to set apart such a huge sum of money for education in India. So far as I can see, it is hardly likely to be forthcoming on this side of doomsday. So the campaign will be more easy if part of the responsibility for educating children in a village is thrown on its residents, subject to well-understood limitations.

There might be two kinds of education imparted in the villages:

(1) vocational, and (2) general or literary.

There should be compulsory and free primary education in India, and this can be realised by teaching the children a useful vocation and utilizing it as a means of cultivating their mental, physical and spiritual faculties. Thus primary education on a vocational basis will pay its way.

The basic crafts to be adopted should depend upon local conditions. These basic crafts may be agriculture, sericulture, dairy, carpentry, gardening and horticulture, leather work, or any other craft for which local and geographical conditions are favourable.

More stress should be laid on agricultural education. India is an agricultural country. Three out of every four persons are devoted to agriculture. Nearly 92% of the Indian people live in villages and agriculture is their one great occupation. If agriculture is unremunerative, the landlord, the *mahajan*, the trader, and the manufacturer must all suffer along with the peasant. Nothing hurt India's internal and external trade so much as the failure of crops. Clear is then the need of a system of agricultural education for the rescue of India and consequently for the Indian peasant.

Now the points for consideration in framing a scheme for agricultural education should be:

(1) The kind of agricultural education to be imparted in the villages,

(2) The teaching machinery and curricula of studies,

(3) Management and control, and

(4) The question of funds.

Before going any further I must say that the entire system of agricultural education must rest on primary education. As I have already suggested, primary education should be compulsory for both the sexes. It should be imparted through these village schools. The curriculum should be so chalked out that it will promote interest in and love for agriculture and rural life. The subjects of study should be: a vernacular, arithmetic, geography, history, elementary botany and zoology, practical agriculture, animal husbandry, religion, music and physical training.

The course of study in practical agriculture, to be followed in such schools may roughly be chalked out as follows:

(1) Tillage and implements.

(2) Seed and seed testing.

(3) Control of weeds, insects and plant diseases.

(4) Feeding of the cattle and their management.

The students should spend more time in the fields than in the class rooms. They should be encouraged to work at home and in fields along with their parents. There is no very great necessity of having demonstration farms for the village schools. The students should be taught and encouraged to apply their knowledge in their own farms.

But in order to make vocational education successful, the literary or the general education should not be discredited. There are some men who think India has had already enough of general education. It is a sad mistake on their part. If literary or general education is stopped, this means there is no way open to higher education. And it is impossible for a nation in this modern world to keep abreast of the times. It is because of the scientists working silently for twenty-four hours in laboratories and dreaming only of their experiments, that the

masses at large are getting all the amenities of their life and are called civilized in this world. Of course, it is true that everybody cannot be fit to receive literary education but this should not be denied to those who actually are fit for it.

These village primary schools should be under the administrative control of the Education Department of the Panchayat Board. In all professional matters relating to studies, teachers, textbooks, tests, etc, the Educational Department of the Local Board or the Distrct Board should supervise.

The staff of the primary schools should be well qualified and trained.

As regards the fees of the pupils, I have already mentioned that the education in primary schools should be imparted free to both the sexes up to the age of fourteen.

The question of funds so far as it is related to village education should be solved by the Local or the District Board. They should grant more money to nation building departments such as education and sanitation. And this can only be done if fresh taxes are levied on harmful luxuries, and showy, useless, foreign articles. Taxation by itself is not bad; the badness or goodness of it depends upon the purpose for which its proceeds are utilized. In the present state of the country the taxes can do a lot of good if the receipts are spent on education or sanitation. Taxes may be so chosen as not to press so severely on the poorest class of the people rather a high level of taxation induces people to be hardworking and thrifty.

Adult illiteracy is also vast. "About twenty crores of people need to be given the elementaries of education and culture." This vast adult population must first be given a knowledge of alphabets, but at the same time there should be provided opportunities of keeping up and using this knowledge. For this, night schools should be established in villages and short courses of training should

be given. After they have come to know the alphabets they should be given literature in simple vernacular on history, geography, home economics, politics and such other subjects which will give gradually increasing knowledge to them.

Then there is the education of women which creates a problem which demands the vital energies of the people. It is useless to talk about the role of women in everyday life. Women's place especially in the home is outstanding. In the home the mother plays no less important a part in the education of the child than the mistress in the class room. Women, in general, have a wider sympathy with young children and have a deeper understanding of their needs and interests than men have. And consequently it may rather be said with no exaggeration that women are better fit to undertake the education of children than men are.

Women are home-makers. But the women in the villages have not understood, or have no knowledge of the ideal of a home. They should be made to understand that their ideal home should be neat and clean, well furnished and decorated. They should know the role of better food and nutrition in life.

And for all these the education of the girls in the villages is essential; rather these ideals cannot be achieved if the women are not imparted more training than has been given to them through tradition. Girls' schools, therefore, should be established in the villages and instruction should be given in child care and training, sanitation and hygiene, cooking and nutrition, home economics and industries, nature study and gardening, handicraft, dairying, literature and such other subjects which may meet the greatest possible needs of the village woman.

In the primary stages the girls' and boys' schools may be amalgamated into one, and one qualified mistress can teach both the sexes, but the course should be different.

IV. Social :—India is a caste-ridden country. The village people are so much fettered by tradition and

superstition that even the best amongst them dare not break the time-honoured convention of society. They never think about the reasons for their deterioration. They leave everything on fate. They have a firm conviction that whatever they get, they get because that is written in their fate.

The villagers have to be taught to improve their condition. They should be taught the history of other nations and have it impressed on their minds that those nations are prosperous which worked with intelligence and diligence and not those which depended upon fatalism.

They should be taught about the necessities of life and citizenship. "Social Welfare" and "Better Living" societies should be formed in the villages which should frame rules and try to elevate the social status of the villager.

Problem of Saving: Most of the farmers do not know where to save and where to spend. When they reap a good harvest they spend extravagantly, but when the yield is low they are put to trouble and have to stretch their hands before others. There are some who have the idea of saving, but do not know the proper way to save. They either bury their money in the earth, or have ornaments made of that or give to somebody else on loan. Thus they are put to trouble in case of need, so in order to inculcate in them the will for saving and teach them better methods of saving the following should be done.

First of all they should be taught individually and collectively the benefits and necessity of saving. They should be taught to save something against an evil day. They should be told that even ants set aside something for the rainy season. It is better to save something for an evil day than to incur debt in time of depression and distress, and liquidate it in time of prosperity and happiness.

On the threshing floor they should set apart say a maund or two in the name of their wife or children. If

they consume say fifty maunds they would not be put to trouble by setting apart five maunds for an evil day and living only on forty-five maunds.

If they save in cash, they can deposit the sum in a saving bank of the nearest post office, and when in need can withdraw the money. The central bank should organise the distribution of *hundis* to every home and open an account in the bank. Every labourer or villager should deposit the money in *hundi* instead of spending it on drink or for any other undesirable purpose. At the end of every month the money should be collected and the accounts entered and after a reasonable amount is gathered, the villager would get a chance to buy a cow or a buffalo or cloth or any other necessity.

But before this campaign of saving can bring them any good, the minimising and discouraging of extravagance is also necessary. Many families have been ruined in maintaining their supposed prestige by heavy expenditure in social functions, as weddings, deaths, feasts, and on occasions of thread ceremony and the like. Everybody wants and realizes the necessity to minimise the expenses in the above-mentioned matters. But the question is who is to bell the cat.

This can be done by the following method. First of all the villagers should be made to understand the disadvantages of extravagance. Then a social welfare committee should be formed. It should comprise at least three-fourths of the families of the village. From among them a committee should be formed of about five or six members. Every member should sign a paper promising that at the time of the birth of a child, marriage or death or any ceremony he should spend according to the, recommendations of the committee. And if he does not he would pay the fine imposed by the committee. It should be the duty of the committee to fix the expenditures of the members subject to prevailing circumstances and to see whether the members abide by its orders. If any one violates the orders, the committee should impose the necessary punishment on him. If the man pays the fine

and agreeing with the judgment of the committee apologizes for his mistake, so far so good; if he does not and breaks his promise again he should be boycotted from the society. If in the beginning this course is followed, there will not arise any question of social boycott.

But it should be remembered that the women of the family have great control in the matter of expenses. So there is the necessity of stimulating the sense of economy and frugality in them also. The women also should be invited to attend the meetings of the committee, because their co-operation is also necessary. Thus the social evils of the village can be stopped by the formation of social welfare committees.

Then there comes the question of decreasing and minimising the habit of litigation in the villages. If the strifes and quarrels of the village are decided there, most of the evils of litigation can be stopped. It should be made clear to the people the disadvantages of excessive litigation. They have to bribe the pleaders, *mukhtars*, police, *peshkars*, and many other middlemen. They have to suspend their work at home and run frequently to courts. They have to flatter the witnesses and even then they are not sure whether the judgment would be in their favour or not.

But if these petty strifes and quarrels are decided in the villages itself by the Panchayat, they will not have to undergo these difficulties. They should be persuaded to decide their strifes in the village Panchayat. They should not file the case in the courts till they get permission from the Panchayat. If anybody does in defiance of it, the Panchayat should punish him. There should be a fixed day in the week for hearing these cases. The judges should be honest and impartial and should judge the cases after exhaustive and impartial investigation.

Then comes the question of recreation and amusement in the villages. There is no source of amusement or recreation in the village. The villagers have to spend an uninteresting and monotonous life with the result that

most of the promising young men leave the village and settle in towns or cities. So something should be done to make village life charming and interesting. For this a club should be formed of the young men of the village, in which they should organize music classes and arrange theatres and dramas. There should be an arena for wrestling, and other indigenous games such as tug-of-war, races, and *kabaddi* should be encouraged, If there is any space for football or volleyball, these and some other cheap and useful games might also be introduced. The finances for the materials and equipments for music and games should be met by raising subscriptions from the villagers. For this each member should, at the time of threshing, give five seers or so according to his means. In the beginning they should start with such games as incur no expenses.

Thus village life can be made charming and interesting by the formation and proper working of Social Welfare, or Better Living or any other such committees.

V. Health and Sanitation.—If we carefully ponder over the following heart-rending figures of mostly preventive diseases and deaths during the short period of only ten years in our land, though the figures are old, we would come to a conclusion as to where the blame lies. The total number of deaths for a period of ten years from 1915-1924 was 62,504,410 of which 50,327,407 deaths were from fevers chiefly malaria. Most of these deaths were from preventible diseases. Just realize the fact! The average length of life in India now is about 26 years whereas in New Zealand it is about 60 years.

This low expectancy of life is due mostly to malnutrition and the unhealthy and unsanitary condition of the Indian villages. At present what benefit there is available in India from modern medical science is enjoyed cheafly by the urban minority of the population, and the villagers are largely left to their own fate.

The whole organization of the Medical Service has got to be readjusted primarily for the good of our villagers by whose tax it is being mostly maintained,

So with regard to sanitation and preventive measures there should be an effectively organised Rural Health Department. The health officers must have zeal and a spirit of service in their methods of propaganda and work, so as to make themselves the villagers' friends. They should inspire confidence in the villagers; otherwise their efforts would be futile.

Again for physical improvement they should be taught the advantages of sanitation and hygiene. There should be Health and Sanitary Boards in the villages whose work may roughly be chalked out as follows.

At first the Board should collect and verify the vital statistics of the village and should think of some improvement in the method of reporting the cases, because most of the deaths and infectious diseases go unreported, often the tendency of the villagers being to hide the deaths or infectious diseases from the officials.

Then the Board should provide some arrangement for the training of minor village oficials in matters of health and sanitation. It should arrange for some talks and lectures to the school population and general public on problems relating to health and sanitation.

It should devise means for the prevention and control of communicable diseases. It should arrange for the vaccination of all available children and revaccination in schools. It should set up anti-rat campaigns and the destruction of stray dogs. It should provide facilities for the treatment of malarial cases.

Again the need for maternity and child welfare work is equally urgent. Training should be given to indigenous *dais*, and to mothers. These *dais* should know at least about the treatment of minor ailments of women and children.

School hygiene :—Arrangements should be made for periodic medical inspection, organisation of Red Cross groups, provision of sanitary conveniences, and training in health habits and anti-epidemic measures. Attention

should be paid to the personal hygiene of the scholars and the treatment of their minor ailments.

Construction of manure pits, in which the waste products which are thrown hither and thither in the villages should be thrown and turned into manure, are also necessary. The Board should make provision for the construction of urinals (for males and females) and borehole latrines, and for the improvement of wells.

Food sanitation :—It has been previously mentioned that many of the deaths and diseases are due to malnutrition and unwholesome food. Instruction should be given to the villagers in the sanitary production of milk and in human nutrition. Proper arrangement for the supervision of sellers of edible articles and the collection of food samples should be made.

Nuisance abatement :—The Board should see to the filling up of excavations and ditches as these are mostly the breeding places of mosquitoes and flies ; to the remodelling of tanks, the fencing or demolition of abandoned houses, the removal of piggeries beyond the limits of the residential area, the cutting of rank vegetation and the improving of other undesirable features. It should pay attention to surface cleanliness and open spaces.

Housing :—It should persuade people by instruction to open windows and provide ventilation in their houses. It should instruct them to keep the floors and walls of their houses plastered with mud and to separate the cattle sheds from living rooms and advise them about the construction of new houses on a sanitary basis.

But most of the problems can be tackled by the villagers themselves, by simple precautions, which cost nothing but require a knowledge of sanitation. For instance, many diseases are caused by dirty water in the village tank and many wounds get worse simply because they are dressed with a dirty cloth. If the illiterate villagers are made to understand the value of boiled water and necessity of keeping a wound wet with salt water and dressed with a clean cloth, much of their misery would be avoided.

These are some of the problems of the peasantry which I have tried to tackle. The fact is, that we have developed too much belief in and depend too much on the powers of the state. The craze of depending entirely on the support of the state involves us in the risk of of being in perpetual beggary and bondage, and at the same time losing the virtue of self-reliance. Mr. Russell, while condemning the Irish, observed that, "When a man becomes imbecile, his friends place him in an asylum; when the people grow decadent and imbecile, they place themselves in the hands of the state." We should try to see that this criticism does not apply to India; otherwise I fear, we shall be turned into a race of economic babies, with our lips for ever nuzzling at the nipples of the state.

THE TEN AGRICULTURAL COMMANDMENTS FOR INDIA*

I.—The removal of all surplus water on and in the soil which calls for drainage. The addition of irrigation water where rainfall is insufficient.

II.—Deep hot weather ploughing every third year.

III.—The best seed, including variety and quality.

IV.—Proper spacing of plants.

V.—Intensive cultivation and systematic rotation of crops.

VI.—The judicious use of barnyard manure, legumes, and commercial fertilizers.

VII.—The home production of the food required for the family and for the stocks.

VIII.—The use of more horsepower and better machinery.

IX.—The raising of more and better stock, including the cultivation of grasses and forage plants.

X.—Keeping an accurate account of the cost of farm operations.

* Adapted from the report of the General Education Board, Rockefeller Foundation.

HATCHING AND REARING CHICKENS

By W. R. Chester.

An egg is one of the most wonderful things in nature, not so much as an article of diet as in its capacity to develope under favourable conditions, and to produce independent life. A fertile egg might, indeed, be described as a living organism, for it contains the live though dormant germ from which under the right conditions developes the embryo and the actual chicken. Eggs may prove fertile three or four days after the male bird has been introduced to the stock, though in the generality of cases it is advisable to allow three weeks to pass before setting the eggs, in order to give the stock a chance to settle down. The germ in the new laid egg is not discernible without the aid of the microscope. It is, therefore, impossible to tell in advance whether or not eggs are fertile, and it is equally impossible to forecast the sex of the embryo. An important point to be borne in mind is that the life of the dormant germ is limited and is moreover affected by conditions. The germ loses vitality the longer the egg is kept before being incubated, for it must be understood that actual incubation commences while the egg is in the hen's body, and is merely suspended until a sufficient temperature is encountered to complete the incubating process. Again, exposure to severe cold, and the violent shaking or jerking of eggs depreciate the vitality of the germs, which explains why many eggs sent away by rail for hatching purposes give comparatively poor results. Fresh eggs, if fertilized, will always give better results than those kept more than a week in winter. Eggs intended for incubation should be marked with the date, stored in a tray or shelf in a normal temperature, and turned over every day. Another important point is to collect eggs for hatching twice a day, for should they remain in the nests and be sat upon all day the initial process of incubation may be carried

too far. Before putting the eggs for hatching, see that none is cracked and that they are homogeneous and smooth.

Nature has implanted in the heart of the hen a strong desire to perpetuate her race by sitting upon the eggs she or another hen has laid.

Hatching by means of the hen is the natural process, and therefore the best, though under present day conditions artificial incubation is invaluable as a subsidiary means rather than as a substitute. We are often asked whether a hen is better than an incubator, and we can only reply that a good hen is preferable to a good incubator in proportion to her capacity, and though on the other hand we should consider a good incubator far better than a bad hen, we do not as a rule find it desirable to compare the merits of the two systems on these lines. We have to consider circumstances, and while the natural method would undoubtedly be more economical for the small breeders who raise only three or four dozen chickens every year, the large breeder who raises chickens by the hundreds might find it very difficult to get along with natural methods alone. One hen can only cover a dozen, whereas the capacity of an incubator may be 50 or 100 or 200 eggs. Some strains are specially useful for brooding, the best for this purpose being our 'desi' hen. On the other hand, even in so called non-sitting breeds like Leghorns and Minorcas, hens will occasionally go broody, which in this case is merely a reversion to the natural instincts.

When a hen shows the well-known signs of broodiness, and it is decided to use her for the purpose of sitting, it is as well to allow her to sit for a day or two in the nest box she has been accustomed to use for laying purposes, so that the fever may not pass away. A sitting-box may in the mean time, be got ready. It is best to have the boxes either single or in pairs, so that they can easily be moved for the purpose of cleansing.

An ideal box is made of boards nailed togather 18 inches long, 18 inches wide, and 15 inches high This

box is placed in a quiet and dark place. A spadeful of earth free from stones is placed in the bottom to form a layer of 2 inches of soil in the centre, and more on the sides. It is formed so as to slope gently towards the centre, which is about one inch lower than the sides. It should be beaten down well with the hand, and made round in shape and covered with about an inch of soft hay. There is a door in front to keep the hen on her nest, but this door should be made of half-inch mesh wire netting to admit plenty of fresh air. If the box is too tightly closed, good results are not obtained. For this box can be substituted an earthenware bowl about 18 inches in diameter and 4-6 inches deep which should be covered with a basket big enough to cover the bowl completely and high enough not to touch the back of the hen. The hen saould be moved from the laying house, and placed gently on her nest with eggs under her and allowed to settle down gently and quietly. It is better to do this in the evening, though a good hen will take them at any time of the day.

The number of eggs a hen will take depends upon her size. Nine or ten are enough for a small hen. If more are given than a hen can comfortably cover, the outer eggs get chilled, and as she moves them from one position to another during her period of hatching, they may all get chilled. The critical time is from about the third to the sixth day when the germ is weak. The door should be opened each day at regular hours and the hen allowed to come off for food. If she shows no disposition to leave of her own accord, she should be gently lifted off, the hands being placed under her wings and care taken that no eggs are taken out with her.

The best food is hard grain. Water should be allowed for her to drink and a dust bath provided. Be sure that she evacuates each time she comes off, or she may foul the nest, and should that happen or should eggs be smashed, wash the eggs in warm water and put them back, into a clean nest. It takes 21 days to incubate if the eggs are not stale and the hen is a good sitter. They

frequently hatch on the 20th day. A great deal depends upon weather.

It is better to test the eggs from the 6th to the 9th day to see if they are fertile. A beginner may find it most convenient to take a piece of black or dark cardboard, cut out a space the shape and almost the size of an egg and hold each egg in the aperture before a lamp, an electric blub or preferably a big torch. A well experienced man can dispense with the cardboard and simply hold the eggs between finger and thumb before the light. A little practice will enable anyone to tell which contains a chicken and which is clear. An infertile egg is as clear as a new laid one. The egg should be lifted with the top side as it lies in the box still uppermost, as the chick always lies at the top of the egg to be near to the warmth of the hen's body. On the sixth or seventh day the top of the egg for about one-third of its depth will be darker than the lower portion, and a dark speck which is the eye of the chick can be plainly seen. If there is a dark room handy this should be done while the hen is off for her daily meal. In any case, the eggs should not be kept away more than a few minutes, and not allowed to get cool. A great deal of disappointment is often saved in this way as well as much loss of time. Where many eggs are infertile *e. g.* where half the eggs are clear as often happens, all the eggs from two hens can be placed under one and the other hen started afresh.

Though nature's way is often the best, hens are very variable creatures. Sometimes they are deficient in heat, and one will hatch well and the next one badly with eggs taken from the same breeding pen. One will chill every egg and bring no chicks, or will break one or more and endanger the rest, or leave the nest and refuse to continue hatching and that at a critical period.

Anyone therefore who wishes to hatch large numbers of chickens must have incubators to remedy the hen's deficiencies. Even when one prefers natural incubation it is well to have an artificial incubator at hand in case

of a hen forsaking her nest, or in which to place eggs a day or so before hatching, lest the hen should break the eggs or crush the newly hatched chicks. If the hen does well, and is a gentle creature, as she often is, it is better not to take her from the nest after the eggs begin to chip. She may be looked at once or twice in the day and the egg shells removed. Let the hen remain on the nest till all the chicks are hatched and for some time or a whole day afterwards. The chicks are better without any food for 24 hours and are warmer with the mother on the nest than if removed to a coop. If she is restless, as she sometimes is, if the hatch is a prolonged one, either the chicks should be removed to the warm drying box of an incubator, or in a cosy basket lined with hay near the fire, or the chicks should be allowed to stay, and the eggs late in hatching be removed to an incubator or to another hen.

The principle of hatching by artificial means is as old as the hills having been practised by the Egyptians for many centuries, while the Chinese are reputed to have been specially skilful in this work. In the light of modern improvements these old-time methods, however, appear to have been somewhat crude, proof of which is found in the clay incubating oven found in Egypt. Modern incubator manufacturers have endeavoured to copy nature as closely as possible, or rather to produce the natural conditions, and if they have not quite succeeded it is simply because the gulf between flesh and blood and feathers on one side and wood and metal on the other side is unbridgable. However, substantial progress has been made in overcoming the chief difficulties, though comparative failures are sufficiently numerous to impress the moral that however good a machine may be, an intelligent understauding of the .principles of incubation and practical experience are essential to make success reasonably certain.

Although there are many designs, modern incubators embrace two distinct principles, in one of which the desired temperature is maintained by means of a hot water tank, heated by a lamp or gas jet, while in the other the

heat is provided directly by the lamp, which warms the air as it enters to be distributed uniformly among the eggs. The purchaser's first work is to understand the principles on which the machine works, and faithfully carry out the directions. Regular and intelligent attention is the great secret of success.

The best place to keep the incubator is in a dry cellar or a room which keeps a fairly even temperature. Great care is required in the daily trimming of the lamps to see that they do not smoke and the eggs want regular attention after every fourth hour when they should be turned and given an airing as directed.

The correct temperature of the egg drawer as shown by the thermometer when placed as directed is about 104° but may vary from 102° to 105° with safety. The machine should stand quite firm and be perfectly level, when tested by a spirit level.

Eggs should be tested on the seventh day as directed before and again on the fifteenth day. On this latter testing, any eggs which have not made satisfactory progress, and are addled or in which the chicks are dead, should be removed, as they otherwise foul the air in the incubator and damage the rest. The egg containing the live chick is by this time quite opaque except at the broad end, where the air cell is plainly seen. The bad eggs are less opaque and often look cloudy and irregular in colour.

When the chicks are hatching the drawer should not be opened more than two or three times during the day, and then only for a moment to remove those which are quite dry and strong to the drying box, in which they should remain for 24 hours without food.

Rearing chickens:— The chicks must be reared either by the hen or in foster mothers. In the case of the hen, when she has finished hatching her brood, she should be well fed with maize or wheat and be well dusted with insect powder to free her from lice. The dusting is best done, however, a day or two before she finishes her task.

She should then be placed in a coop and the chickens be put to her. A hen will take chickens from the incubator as readily as those she has hatched, if they are placed with her own while she is on the nest, or if they are of the same colour as her own. A hen has no head for numbers, but a keen eye for colour, and if chicks of a different colour from her own are placed with them, she will often kill them outright. She will also kill her neighbour's chicks if they stay with her, unless they are of the same age and colour.

The day-old chickens need no food for thirtysix hours, being naturally provided for before they leave the eggs. Feed the chicks on dry food such as cracked wheat or *bajra* for the first 10 or 14 days, giving it little by little every two hours. Clean fresh water or preferably skim milk should be ready at hand always. After two weeks, when the chicks will be well able to run about, they should be encouraged to feed outside their coop. Some people prefer to rear chickens entirely upon hard grain but with reasonable care better results may be obtained by giving one or two feeds every day of soft stuff. Small grit is also necessary to assist digestion, and until the birds are able to run about and find fresh green food for themselves a little tender cabbage or lettuce leaf or onion tops could be chopped up and given every day along with the soft food.

With artificially reared chicks the feeding is similar. There are many good brooders on the market and the directions should be followed. The best test whether all is going well is when the chickens eat well and drink moderately and when they lie about the sleeping compartment well spread about the whole of it and not huddled into one corner. The chief dangers are:—(1) Over-crowding, (2) Over-heating, (3) Droughts. All may be avoided by care. It is not well to place more than 5? in one reaper, and most of the brooders advertised to take 50 are much better with only 30. As the chicks grow and take more space, great care should be taken against over-crowding. In winter they may remain in a brooder

till six weeks old but in warmer weather they may be removed to a cool brooder after a month.

A cheap cool brooder may be made at home by using a hurricane lamp. If a coil of fine meshed-wire netting, say 15 inches deep and 9 inches in diameter be nailed to aboard about 10 inches square, the lighted lamp may be placed inside the coil and the whole placed in a large coop or small poultry house. It gives sufficient heat for the chicks till they are old enough to do without it. If the coil of wire is covered with a jacket of linen, it keeps out the dust and dirt and the chickens nestle around it. The coop should be well ventilated and if the roof gets too hot through nearness to the lamp, a sheet of tin should be nailed on the under side, which will both afford protection from fire and throw down and distribute the warmth.

The secret of successful rearing is to keep the chicks growing from first to last without any check. To do this, care must be exercised to keep them from colds and other chicken ailments, free from insect pest, and to give them suitable food and comfortable housing. Until they are a month old, they should be fed four or five times a day little by little, after that till they are three months old four times, and from then till maturity, three times.

"A tremendous number of eggs are spoiled during hot weather because these eggs are held at high temperatures. Eggs should be gathered in a wire basket and put in a cool place at night to allow all heat to escape. Never place freshly-gathered eggs in cases immediately. The temperature of the eggs should first be reduced, and the eggs placed in cases some time later."

—The Furrow

REPORT FROM THE DEPARTMENT OF AGRICULTURE, UNITED PROVINCES

FOR DECEMBER, 1937.

I—Season.—The first half of December was practically rainless but the rainfall in the latter half was general and above the normal in most districts only Benares Division reporting no rain during the month. More rain is, however, needed in a number of districts specially those which received little or no rain in the month.

II—Agricultural Operations.—Agricultural operations are well ahead. The irrigation of *rabi* crops, crushing of sugarcane, preparation of land for extra crops and sugarcane are in progress.

III—Standing Crops, and *IV—Prospects of the Harvest.*—The crops are reported to be doing well and prospects are favourable. Out-turn of sugarcane crop is estimated from 70 to 80 per cent. of the normal.

V—Damage to Crops.— No serious damage to crops is reported. Frost is reported to have caused some damage to crops particularly to *arhar* in some districts.

VI—Agricultural Stock.—The condition of agricultural stock is satisfactory. From the report of the Director of Veterinary Services, United Provinces, it appears that cattle diseases except rinderpest have further declined as indicated by the following figures furnished by him :

	NOVEMBER, 1937		DECEMBER, 1937	
Disease	Seizures	Deaths	Seizures	Deaths
Rinderpest ..	1,398	769	1,595	840
Foot and Mouth ..	2,513	27	1,342	17
Hæmorrhagic Septicæmia	308	284	106	78

VII—Pasturage and Fodder.—Fodder and water are sufficient everywhere expect in Muttra, Agra, Farukhabad and Cawnpore where fodder scarcity is reported in certain 'tahsils'.

VIII—Trade and Prices.—The prices of wheat and gram show a tendency to rise, others have fallen slightly. The following figures compare the average retail prices in rupees per maund at the end of the month with those of the preceding month :

	End of November, 1937	End of December, 1937
Wheat	3·441	3·543
Barley	2·688	2·313
Gram	2·375	2·415
Rice	4·048	3·984
'Arhar Dal'	5 076	4 920

IX—Health and Labour in Rural Areas.—Condition of labouring and agricultural population is satisfactory. Plague, cholera and smallpox are still reported from places.

" While it is recognized that water consumption varies with the season of the year and prevailing conditions, it is interesting to note that a horse consumes about 10 gallons per day. A cow will require approximately 12 gallons ; hog, 2 gallons ; sheep $1\frac{1}{2}$ gallon ; while 100 chickens will require 4 gallons each day."

—THE FURROW.

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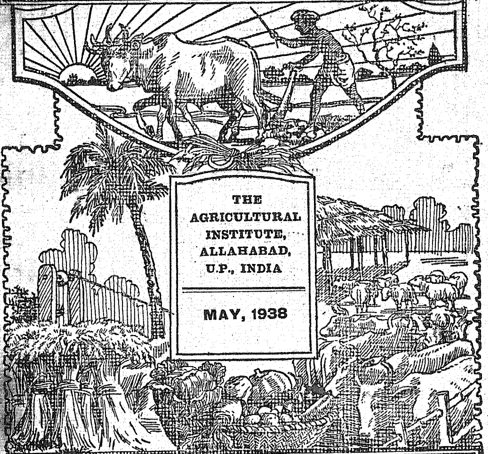
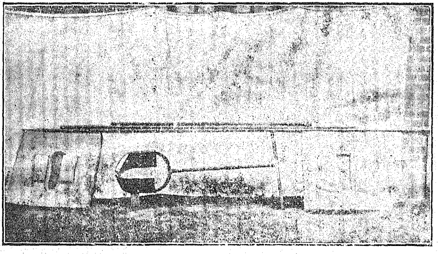
OF
Agriculture and Rural Life



"Whenever a civilization has allowed itself to deteriorate, that civilization has perished. This is not due to an economic factor but to a cultural factor."

DR. MARK A. DAWBER.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility and sanitation, and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

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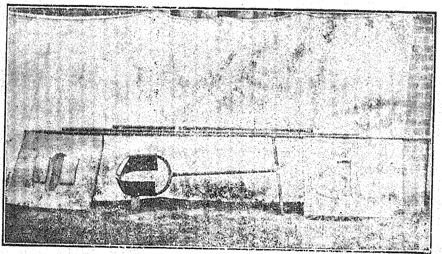

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Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by $3\frac{1}{2}$ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the shear broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

MANAGING COMMITTEE

Editor ... ... B. M. PUGH

Contributing Editor ... DR. SAM HIGGINBOTTOM

Business Manager ... W. B. HAYES

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Contributions

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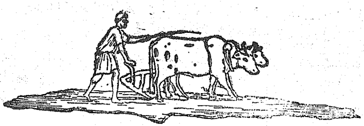


VOL. XII] MAY, 1938 [No. 3.

Editorials

Dr. Higginbottom on furlough.

May we through the medium of our magazine inform the readers as well as the public of the absence of Dr. Higginbottom from this country for one year? He left the country late in April for his furlough in America. The institution of which he is the head and the destinies which he has guided for about thirty years will miss him during his absence. But in these days when this country is forging ahead in making plans for the building up of a great Indian nation, the absence of Dr. Higginbottom from this country is not, we believe, altogether without a meaning. He has gone to try to increase the resources of his institution which has also during the last few years made such rapid strides, that it is becoming increasingly difficult to keep up financially with the needs of the institution. The home-making department for women which has been running now for two years at the Institute is also in need of funds in order to bring it up in line with the crying need for a good strong woman's institution in the country. This and many other things will keep him busy in America during his furlough and we therefore do not grudge his absence from us and from the country for a short time.

Hindustani as a medium of instruction.

We welcome the move in this country to make Hindustani the medium of instruction in colleges at least up to the Intermediate standard. This we believe is a move in the right direction. But much as we believe in it, we feel that the move should be planned more carefully than what seems to be intended at present. Text books in the language in which the students have to be taught have to be prepared. And as far as we know, text books on the subject of Agriculture in Hindustani do not exist. We would suggest that Government should take steps to see that at least one text book for each subject to be taught is available in Hindustani before attempts are made to teach those subjects in that language. Otherwise in the intervening period the e is a very serious danger that the students cannot learn much. The preparation of text books take considerable time. Hence it would be well for Government to subsidize professors who intend to write text books in order to enable the study of those subjects in Hindustani.

We also welcome the very broad-minded suggestion of the President of the Congress to use Roman letters for Hindustani. This will simplify matters for those people in other parts of India who may not know Hindi or Urdu, besides the very great advantage that books may be more decipherable to a foreigner and people of other nations all over the world. This will also help to bring the Indian nation one step nearer to the other nations of the world, while in this country it will have the tendency to make the people of India one nation.

Molasses for alkali lands

One of the greatest, if not the greatest, agricultural problems in these provinces is the reclamation of what are known as alkali or *usar* lands. There are thousands of such areas in this province where not even the worst type of grasses can grow. If these lands can be made productive, what a great blessing it will be to the country. Researches for the reclamation of these lands have been made in this country for almost over thirty years now and yet we seem to be very far from finding out the practical method of reclaiming them. It has been sug-

gested and enthusiastically believed by some that the application of molasses is a very practical solution of the problem. With the present technique of conducting field experiments it does not seem to be difficult to find out the practicability or otherwise of this method for the reclamation of alkali lands. Yet so far as we know no extensive researches are conducted in this province under field conditions where the effects of the application of molasses on alkali soils can be watched and observed in the course of two or three years. Such experiments are urgently needed, and we would urge for the benefit of the public, that soil scientists be asked to undertake this as early as possible.

Tenancy Legislation.

The agitation all over the country for reforming tenancy laws is a very healthy sign. For man's relation to the land usually determines his standard of living. A man who cultivates the land he does not own usually has a low standard of living as compared with one who cultivates his own land. It is hoped therefore that the new laws which are being considered and passed in the various legislative bodies in the country will help to make the lot of a tenant cultivator happier and also raise his standard of living. Proper treatment of the land, good cultivation, interest in public life, all these we hope will come as the result of modern legislation for the tenant farmer.

Education in U. P.—It was very gratifying to us to read somewhere that the U. P. Government is proposing to spend eight crores of rupees on education. The present Government should be congratulated on the bold step they are taking. We hope that the money will be wisely spent and that institutions which more completely serve the needs of the province will receive liberal contributions and support from the Government.

SOIL SICKNESS

S. Chowdhury

The term "soil sickness" in its broadest sense may include any condition of soil that renders it unfit for the production of a specific plant in its maximum state of perfection. In such broad sense would be included all lack of proper chemical constituents, presence of undesirable substances, improper physical condition of the soil, presence or absence of certain bacteria or fungi, the presence of moles, worms, and other devastating animal enemies to plant life, and the prevalence of weeds and weed seeds. The consideration of all these varying factors here would lead too far afield, and the subject for the present purpose is limited to a much narrower sense *viz.* to those conditions of soil brought about by the presence of organisms capable of living parasitically on cultivated plants, thus inducing sickness in plants.

Classes of Soil Sicknees Producing Organisms.— Soil sickness in the sense defined above is caused chiefly by three classes of organisms: bacteria, fungi and nematodes.

Nematodes.—Nematodes, nemas or 'eel worms' are minute worms barely visible to the naked eye. There are many species of nematodes which live in the soil, but few of them do injury to plants. "The eel worms are the source of a great deal of soil sickness. The most important types of eel worm diseases are the root-rot caused by *Heterodera radicicola*, the leaf, stem and bulb trouble due to *Tylenchus dipsaci*, the wheatgall disease caused by *Tylenchus tritici......*".

Fungi.—The fungi are the sources of the largest number of soil sickness. A great variety of fungi are found in the soil which are responsible for a large number of plant diseases and the monetary loss resulting from their ravages is very considerable.

One class of soil sickness due to fungi, known as 'damping off' is caused by fungi from the soil invading the

stem tissue near or at the surface of the ground, there causing a softening or rotting with the result that the plant falls over and dies. This very serious trouble is encountered, especially in seed-beds, in green-houses or under other circumstances where large numbers of plants are grown under crowded conditions with high humidity and poor ventilation. There are several different fungi which may cause damping off. Some of the most common are the species of *Pythium*, *Corticium*, and *Fusarium*. Some other genera which have sometimes caused damping off are *Botrytis*, *Trichoderma*, *Pestalozzia*, *Sclerotinia*, and *Phytophthora*.

A second class of soil sickness due to fungi is commonly known as 'wilt.' "The genera *Fusarium* and *Verticillium*, contain some of the most common species of wilt-producing fungi. *Rhizoctonia* sometimes also produces a wilting in addition to other symptoms. *Fusarium* produces a well known pigeon pea wilt. Plant pathological literature contains references to many other wilt diseases caused by species of *Fusarium*, *Fusarium* wilt of potato, pigeon pea and cotton are of great economic importance. A species of *Verticillium* causes a wilt of egg plant, cucurbits and other plants."

There is a third class of soil sickness due to fungi commonly known as 'root-rot.' There are many species of fungi which have the ability to cause root-rot in plants. Among the genera containing root-rotting species are *Helminthosporium Fusarium*, *Rhizoctonia*, *Corticium*, *Ophiobolus*, *Gibberella*, *Thielavia*, *Sclerotinia*, and *Armillaria*.

"The *Rhizoctonia* fungus *Corticium vagum*, is responsible for a great deal of root-rot trouble among cultivated plants. Peltier has reported that *Rhizoctonia* attacks a large number of truck crops, among them the following: beet, bean, cabbage, cauliflower, celery, cucumber, eggplant, horse-radish, lettuce, muskmelon, pepper, radish, squash, sweet potato, pea, parsnip, potato, and tomato. The violet root-rot of potato, onion, asparagus, carrots, clover and many other plants is due to *Rhizoctonia crocorum*. A root-rot of beans, horse-radish, tobacco and watermelon is caused by *Thielavia basicola*. Species of *Sclerotinia* cause root-rots in such plants

as clover and carrots. *Armillaria mellea* causes the well-known root- rot of both fruit trees and forest trees."

"Henry has recently shown that *Helminthosporium sativum Fusarium graminearum,* and *F. moniliforme* are among the most virulently pathogenic organisms." Mitra has shown that *Helminthosporium sativum* causes the most serious foot-rot disease of barley.

In addition to those soil fungi which may be designated as damping off, wilt-producing, or 'root-rotting, fungi there are others of a miscellaneous nature which persist in the soil for a longer or shorter period of time. Examples of some of these fungi are the onion smut fungus, *Urocystis cepulæ* the cabbage club-root organism. *Plasmodiophora brassicae,* and the potato wart parasite, *Synohytrium endobioticum.*

Bacteria—"Apparently there are not as many parasitic bacteria as there are fungi which live indefinitely in the soil, yet there are a number of bacterial diseases of plants, the causal organisms of which can live for sometime in the soil. Among them may be mentioned the bacterial brown rot of potatoes, tomatoes and other plants caused by *Bacterium solanacearum*, the soft rot of vegetables due to *Bacillus cartovorous* and the crown gall organism, *Bacterium tumefaciens.*"

Importance of the Study of Soil Sickness.—Soil diseases prevail on staple crops in every part of the world, a very large variety of plants are affected by soil sickness.

The variety of plants attacked by soil diseases, the importance of the crops and the range of territory occupied, render them of special importance. Their chief claim to attention from an economic point of view lies in the fact that they stand not merely for the loss of a single crop, but for the loss of the affected land for the purpose of raising the susceptible varieties of plants for years, often for decades. If the susceptible crop is one of high importance in the community if it is one of the staple crops or if it be the only money crop the depreciation in the market value of the land is very marked often as high as 50 or even 70 per cent.

Any of the three groups of organisms may reside in affected soils in untold numbers, often millions in a single spoonful. They subsist on the debris of earlier crops of the susceptible plants, on plants of close botanical affinity, on other organic constituents of the soil, or they may remain in a dormant condition, according to specific habits.

How the Organisms Work.—When plants subject to attack are grown in infected soil, and the roots and the disease-causing organisms come in contact the parasite penetrates the roots, or the stem near the surface of the ground, and induces the disease.

In the case of nematodes the response of the plant to attack usually consists in accelerated growth of the adjacent cells, resulting in gall formation, each gall usually marking the point of primary entrance of a nematode.

Certain fungi produce galls somewhat similar in general appearance, as the crown gall. The entrance of bacteria or fungi, however, usually produces no such symptoms, nor do the organisms remain local. They usually migrate by growth through the root tissues until they gain access to the veins. In these open passages they increase and rapidly extend longitudinally throughout the plant. So rapid is the growth of the parasite, whether bacteria or fungus, that the veins soon become to a large extent plugged, often so completely that the rise of the sap in the plant is entirely cut off. This interference usually results immediately in a wilting of the foliage, hence the name 'wilt' so widely and appropriately applied to these diseases.

Means of Dissemination.—In general anything that leads to a distribution of diseased soil or diseased plant in unaffected soil brings about a spread of the disease. Some of these means are obvious; for example washing from higher to lower lands. It is frequently noticed that when the higher lying fields become affected, the adjoining lower lands first show disease in those parts receiving drainage water from the diseased lands. Soil adhering to tools, ploughs, cultivators, hoes, to the feet of animals or

men, may similarly carry contagion. Diseased plants may serve as carriers of the germs in many ways. Of these, transplanting is one of the most important. Plants from a diseased seed-bed as in the case of club-root of cabbage and other crucifers, may carry contagion to previously healthy fields. Dead plants, each small part bearing millions of the germs of disease, may similarly convey the disease. Broken bits of leaf, twig or root adhering to tools, caught by the wind or carried by a careless passer-by may start a new centre of infection. This mode of spreading becomes particularly important when the dead parts of the diseased plants have feeding or manurial value. If infected parts be used in manure, certain infection will result. If infected parts be used as feed, the germ may pass through the animal in a viable condition, or, in cases when this is not possible, bits of germ-laden refuse may find their way from the stall to the manure heap, where as a rule they will remain alive for months and where they will in many instances even grow and mutiply. Dissemination in this way is frequent in the case of the cruciferous club-root, as when the refuse leaves, stalks and heads of infected cabbage are fed to stock.

The longevity of the germs in soil varies with the species and conditions. If a suitable host crop is on the soil, all of them are probably capable of indefinite existence. Some species of germs will die within a few years if deprived of their host plants; other species live many years. Many are well nigh omnivorous and can subsist on almost any organic substance; others are extremely exacting and require their own host plant if they are to multip'y. Many species can be dormant in the soil for long periods.

Means of Prevention.—With soil diseases it is above all necessary to prevent rather than to rely on treatment after the soil becomes diseased. This is true both because of the inefficiency of the treatments and the efficiency of prevention.

In general, the means of prevention may be inferred from the paragraphs on dissemination. Every precaution to guard against the disseminationof the disease should be taken.

This includes a watchful care over manures to guarantee their freedom from germs. The use of commercial fertilizers, when uncontaminated manures cannot be secured, is by far the safest method. Spread of the disease by washing of the land may often be prevented by suitable dikes or terraces, and spread by means of dirt on tools by careful cleaning, followed by sterilization, that is by a washing in 5 per cent. carbolic acid before passing from infected to healthy soil. Care should be taken to convey as little infected dirt as possible on the feet of workmen and domestic animals. If soil is to be used in inoculation for legumes, it must come from unaffected fields. Plants and nursery stock from diseased fields must be carefully guarded against. With these precautions, the encroachment of the disease on new territory may be greatly retarded or altogether prevented.

Treatment of Affected Soils.—Many chemicals and mixtures have been applied to soils with the hope that thereby the disease germs might be killed, but in few instances has this proved effective. The use of lime in large quantities for club-root of the crucifers and of sulphur for onion smut nearly comprises the list of such remedies. In most cases chemical treatment of soils is barren, although applications of carbon bisulphide are reported to have been efficacious on grape-sick soils in parts of Europe; when the amount of soil to be treated is small, as in a green-house, sterilization by heat is sometimes practicable otherwise not.

Crop rotation, employed in order to deprive the germs of their sustaining host, will in many cases bring about either total or partial recovery. This is notably true concerning the club-root of crucifers. In cases when crop rotation is not wholly effective it may so far result in the recovery of the soil as to enable the susceptible crop to be raised once in each three or four years without serious prevalence of disease. In the employment of crop rotation, weeds or cultivated plants of close botanical affinity to the affected crop plant must be zealously guarded against. A wild weedy crucifer may harbour the germs of the club-root, or a weedy

(*Continued on page* 105)

'ORIGIN AND CHARACTERISTICS OF THE MOST COMMON BREEDS OF CHICKENS'

By T. R. Kesavan, G.B.V.C., D.V.M., F.F.Sc., P. G.,

Vet. Research Officer, Jammu and Kashmir State

The most frequent question asked by people who contemplate raising improved breeds of chicken is "What breed is the best to raise? It all depends upon circumstances, whether or not the desired breed is available and what the chickens are wanted for. Some of the principal breeds that can be raised successfully in all parts of India under proper care will be suggested below.

Description of Breeds

Plymouth Rock.—The Plymouth Rock is an American breed first produced in Massachussetts. They are dual purpose birds, greatly esteemed for their meat and high egg production of large sized brown eggs. There are six known strains; barred (common here), white, buff, partridge, silver and columbian Plymouth Rocks. Cocks weigh from 7 to 9½lbs. and hens 6 to 7½lbs. each. The breed is characterized by the red ear-lobes, medium sized single comb, yellow beak and legs and yellow skin.

Rhode Island Red.—The Rhode Island Reds originated in Rhode Island and Massachussetts. They are much like the Plymouth Rocks in size and conformation, but the Plymouth Rocks tend to have straight lined beak and ventral side. They are general purpose birds that lay large brown-shelled eggs and in colour they vary from dark to light red. They come in two strains; the single combed and the rose combed, the first being more popular. They have red ear-lobes, yellow skin, yellow shanks; toes and beak usually tinged red.

Orpington.—The Orpington is a dual purpose English breed. There are three well-known strains; black, buff, and white. It is the heaviest of the dual purpose breeds in England. Cocks weigh from 8 to 10lbs. and hens 7 to 8lbs. each. They are characterized by their pink white shanks, toes and beak, red ear-lobes and white skin, medium legs and large round body. They lay brown-shelled eggs.

Minorca.—The Minorca is now considered to be an English breed, brought to England from Minorca Island. It is really a grand layer of extra large white eggs. Besides this, it possesses an active, industrious, contented disposition with a massive and compact looking body. There are two strains; black, and buff and white, the former being more common. They are characterised by white face, ear-lobes, and white skin, medium sized legs and dark, slate-coloured shanks; the comb usually single and rose. Cocks weigh from 7 to 9lbs. and hens 6 to 7½lbs. each.

Sussex.—The Sussex is of Kentish origin. The pure breed has delicate white legs with, as a rule only four claws, very broad and square, and varying colour, but chiefly brown or hay. In place of this old breed, a new race is now manifested and this is common here. The hens are very light buff or wheat-colour, approaching some times almost to white; the cocks much darker, of red and black colour. They have red ear-lobes, white skin, single comb; the shanks usually unfeathered and look the colour of a horn. Cocks weigh from 7 to 9lbs. and hens 6 to 7lbs. each. They lay brown-shelled eggs.

Leghorn.—The Leghorn originated in Italy and was formerly called 'Italiana'. It was imported to both Great Britain and America and is now recognized as commercial non-sitting egg laying breed. There are several strains; white (very common here), dark brown, silver, light brown, buff, black, pale and red, which may be single or rose combed. Cocks weigh from 5 to 6lbs. and hens 3 to 4½lbs. each. The breed is characterized by its yellow beak and legs, yellowish skin and big white ear-lobes. They lay large white-shelled eggs.

AGRICULTURAL BIAS IN SECONDARY SCHOOLS

(Advanced Training)

BY K. A. PATWARDHAN, DALY COLLEGE, INDORE

In a previous publication it has been described how the *kumars* at the Daly College are being initiated in the practice and economics of agriculture as locally practised. This was however considered not enough to enable them to put their training to practical advantage. If the *kumars* as recommended by the Royal Commission (App. a) "are to manage their own lands" and "take a full and active part in the life of" the rural communities, more attention must be paid towards training in "Agricultural Economics" and "Estate management." It appears that this can only be effectively done if as recommended by Sir John Russel "The entire holding is considered as a Demonstration plot." (App. b).

Obviously it became necessary to provide the *kumar* even in the preliminary stages with the environment of a rural holding. Further when he finishes his preliminary training he must be given facilities and guidance to study the economics and to manage the working of agricultural holdings typical of his own district. It was therefore decided.—

(1) to remodel the Daly College farm so that it represented one holding managed by one cultivator's family—man, wife and 2 or 3 children and (2) to initiate an advanced two years course for the *kumars* that had already been through the preliminary stage. During these two years he should organise on an economic basis a similar one tenant holding on his lands on the lines of the College farm adapted as may be found necessary to his local surroundings.

Remodelling of the College Farm as an economic holding:—For four years before April 1937, the College farm was managed by paid labour. During this period

the cropping system, equipment and labour adjustments were progressively improved year after year in the light of the experience gained till ultimately the farm began to pay not only its own way but to leave a surplus. (App c) On the basis of this experience it was remodelled as an economic holding capable of maintaining one tenant family. At the same time facilities were retained to train the *kumars* in the technique of practical farming and its economics. They could thus make themselves familiar with the cultivation and economics of local crops exactly as the farmer grows them. Also, they could have an opportunity to study in detail a typical economic holding similar to those they will have to organise on their own estates in order to manage them on stable and profitable basis.

The main points in the reorganisation of the Daly College Farm:—

(1) The College Farm was given on lease to the cultivator on payment of a rent of Rs. 60 per annum *i.e.* Rs. 3 per acre.

(2) Two bullocks and implements (App. d.) were hired to him at Rs. 10 a year.

(3) Depreciation on these was charged at Rs. 30 a year *i.e.* 10 per cent. of the investment, so that the amount recoverable from the farmer amounted to Rs. 100 per year.

(4) Money for current expenditure for cropping and bullock-feed was to be advanced without interest to him—as required—to be recovered from him at the end of each season—*kharif* and *rabi*.

(5) In return for this advance the tenant was to give facilities for training to the *kumars* in the same way as were available when the farm was managed by the College.

(6) The same type of supervision and records were to be maintained

(7) The system of cultivation and rotation was to be the same or as modified in future by the College authorities due to improvements suggested by experts.

(8) The College was to ensure the maintenance in proper condition of implements and animals by insisting on systematic upkeep and feeding.

(9) These were to be replaced when necessary provided the deterioration was normal or due to causes beyond the control of the cultivator.

(10) The existing accommodation for housing the tenant, the bullocks and the implements, the produce and other store was to be continued and was, as before, to be subject to supervision and control by the College authorities.

The following is an outline of the scheme providing facilities to the ***kumars*** to make themselves familiar with the working of an economic holding for one tenant family in his own tract or district:—

1. On the basis of their experience of the working of the reorganised unit at the Daly College farm the ***kumars*** were advised to determine by actual trial the requisites for an economic holding on their own lands. The procedure was this. An area of about 20 acres was to be leased to a tenant family (man, wife and two children) and equipment consisting of one pair of bullocks and the requisite set of local type of implements with accessories, was to be provided besides funds for running expenses of cultivation. The cost of equipment was to be considered as a loan to be liquidated in 5 annual instalments. The funds for current expenditure bore no interest and were to be returned by the end of the season. The system of cultivation and crops with which the tenant was already familiar was to be adopted in general but grossly disadvantageous items were to be excluded or modified as necessary.

2. A unit was to be considered economic if it enabled the cultivator to maintain himself and his family at the

standard of living normal to the locality and still left a surplus for payments of (1) land tax and rent (2) instalments for the re-payment of his loan (3) depreciation on his equipment, and (4) defraying of expenses incurred for cultivation and repairs to his equipment. The instalments for the part payment of loans were to be included as a permanent item to make provision for spare surplus to meet unforeseens which always occur even when there may be no need of a loan for the purchase of implements, thus insuring the cultivator against the causes of the indebtedness so usually seen. The *kumars* were to be on a lookout for introducing improvements and adjustments to make the holding self-supporting as described above.

Choice of site:—About 20 to 25 acres of 32 to 40 *bighas* of land should be so chosen that about one-third of it could produce a fair crop irrespective of seasonal character. As far as possible the whole area was to be divided into two nearly equal halves, one for *kharif* and the other for *rabi*, in tracts where crops grow in both the seasons.

Choice of crops and their proportion.—As the crops were to provide food for the cultivator's family, fodder for his cattle, and cash for the payment of his dues and for purchases, the proportions of the several crops grown in the locality were to be suitably adjusted. This was to be done on the basis of the Daly College records supplemented with the results of local enquiry made with a view to ascertain items or amounts likely to differ from the College experimental data. The *kumars* were to manage their holdings through a local conductor acting under their instructions. This was necessary because of their absence from home during the College terms and incidentally this afforded them an opportunity to get a training in estate management exactly on the lines in which they might manage all their holdings in future.

The *kumar* in consultation with the local conductor was to make final choice of the site and prepare a map, indicating the extent of each kind of crop in each season and the rotation adopted for each section. The *kumar* was to draft

an estimate of the expenses and income on the basis of the scheme proposed by him. He was also to make an estimate of equipment and accessories and how and when they were to be provided. He was to draft instructions and forms of entry for recording details for the use of the local conductor. A provision for a periodic report by the conductor on the spot to the *kumar* was to be made on the basis of which further instructions were to be issued from time to time. Personal visits by the *kumar* in vacations were to be arranged whenever necessary, and a note of the observations was to be drawn by the *kumar* with critical remarks to be included in the final report of the whole scheme.

It was proposed that detailed records may be maintained about:—

(1) Budget. (2) Equipment. (3) Cattle-feed. (4) Agricultural operations crop by crop and field by field. (5) Extra labour. (6) Sales. (7) Payments of dues.

Balance sheet.—A balance sheet was to be drawn showing the profits and losses, for the crops of each season, and the current monthly expenditure. The results were to be critically examined at the end and a brief report was to be drafted by the *kumar* with suitable suggestions and recommendations for the future.

The following suggestions based upon the College experience to date were made as useful guides:—

Budget

Man	Implements and Bullocks	Seeds	Extra Labour and Miscellaneous	Feeding of Bullocks	Total
					Rs.
75	100	25	25	75	300

Out of this, Rs. 100 or the cost of bullocks and the implements was to be considered as a long term loan and recovered in instalments of Rs. 24 per year (payable half yearly at Rs. 12 each half year) for 5 years. This covered the interest at 6 per cent. per year. Depreciation at the rate of 10 per cent. per year was also to be charged from the very beginning though if convenient and necessary the actual deduction was to be postponed to a convenient date; 3½ per cent. interest being charged on the sum permitted to remain unpaid for the period of postponement.

The expenditure on man, feeding of bullocks, seed, extra labour, etc. was to be recovered in two instalments, once at the end of *kharif* and the rest at the end of *rabi* crops, the proportion depending upon the relative values of crops.

Land tax and rent included the Government dues assessed for the fields and the normal rent charged in the locality by the owner. Even if the tenant owned the land himself the ownership charge could not be omitted because it was the return on the capital invested on the land. In short the amount of money to be advanced, either in cash or kind, was not to exceed Rs. 200 during the first six months and another Rs. 100 later on during the year.

During the second year the cultivator was not expected to need an advance of more than about Rs. 50 or so and by about the third year he ought to have no necessity of a loan but was only to return the instalments of the original loan taken before.

Out of the total loan of Rs. 300 the cost of permanent equipment such as bullocks, implements etc., was to be recovered as mentioned above at Rs. 24 per hundred. This included 6 per cent. interest per annum. Out of the remaining sum, the money advanced for perishable articles, such as seeds, feeding and other things was to be fully recovered the same year, interest being charged at 6 per cent. so that a proportionately longer time was to be allowed for the payment of the money advanced for purchasing the type of equipment likely to last more than a year.

Equipment.—A record of all permanent equipment—bullocks, and implements was to be kept for further reference. The age of the bullocks with their cost, the name of the implement and cost, description about the material used, the sketches to scale, and any other important details were to be noted. Besides a pair of bullocks the farmer was to have a plough, a *bakhar*, yokes, seed drills, *dauras* etc. The sample of columns needed for such a record:—

Date	Name of article	Source	Rate	Cost	Remarks

Cattle Feed.—A full record of the articles purchased or collected for feeding—grass, gram, cotton-seed, oil and salt was to be carefully kept. Arrangements were to be made for preparing silage towers or pits to solve the question of cheap succulent fodder and thus reducing the expenditure on it. Cotton seed (whenever available) and gram were to be reserved for feeding the cattle to reduce the item of expenditure on feeding during the next year. The records were to be kept in columns as shown below:—

Date	Name of the article	Quality	Rate	Cost	Remarks

Crop Record.—All the operations connected with each crop were to be recorded on separate sheets. This was to include the preparation of soils, the quantity of seed with

cost, extra labour engaged if any, the quantity and the quality of the produce with the amount gained; the columns for such a record were to be made as below:—

Date	Type of work	Labour hours Men, Women, Children	Cost	Other Expenses	Cost	Total cost	Remarks

Labour Record.—A detailed record of all the extra labour employed for the different operations in the different crops were also to be kept; the amount paid for the extra labour, in cash or kind was to be noted in columns shown below:—

Date	Crop	Work	Extra Men,	Labour Women,	Children	Cost	Quantity of work done	Remarks

Manure.—Every farmer has to dispose of cattle dung, farm wastes and kitchen ash. Farming needs replacement in the soil of plant food and humus used up by cropping. Usually the farmer collects his spare cattle dung in a heap or in a pit. It does not rot properly or quickly. Thus a lot of good plant food is lost. If, however, the cultivator is taught to make rain watered compost from the same raw material it will produce a greater quantity of better manure, it will improve his fields and enable him to get a good return. The farmer or the local conductor was therefore to be instructed by the *kumar* to make compost by the Indore method

so that the problem of manure supply could be solved without involving any extra expenditure. This would also teach the cultivator the most hygienic and efficient method of disposing farm and kitchen wastes. It may be mentioned here that by the addition of a cow if possible or at least a goat to the live stock besides solving the problem of child nutrition, a vital problem which receives very little attention, more dung will be available. Half the dung of his cattle (that part which is not going to be used for compost making) would give him his fuel in the form of dung cakes. The compost thus prepared would be sufficient to manure 1/3 to 1/4 of his land so that all his fields could be manured once every third or fourth year.

Sale Record.—Details of the sale of the crops and other products showing the quality and quantity of the outturn of each crop with the earnings thereon were to be noted and a record kept as shown below:—

Date	Article Sold	Rate	Net Income	Name of the purchaser	Remarks

Balance sheet and report for the year should include.—

1. Name of the *kuma* :—
2. Contents :—
   - (a) Balance Sheet.
   - (b) Description of the site, environment and season.
   - (c) Summary of the cropping.
   - (d) Special points regarding crop-growth, labour and its efficiency, sales, purchases and unforeseens.
   - (e) Conclusions and suggestions.

Siguature of the Kumar.

Remarks of the Master. Signature of the Master.

The above scheme has been put in full operation during 1937-1938. The College farm is being worked as an independent one tenant holding as described above. Other units of about twenty acres are being studied by:—

(1) K. Devi Singh of Barwani (The Minor Rana of Barwani, C. I.) at Barwani in his own State.

(2) K. Man Singh of Mahar at his Jagir in Mahar in Jaipur State.

(3) K. Martand Singh of Rewa (the heir apparent) in his own State.

(4) K. Pratap Singh Rao Holkar of Indore in his own land near Indore in Holkar State, Indore.

These *kumars* have already presented their interim report with full details bristling with enthusiastic comments and suggestions for future adjustments.

It is not too much to expect results of definite utility from this endeavour especially after such a hopeful start and the lively interest of each *kumar* in his work. The economic records so obtained will be really representative of the economics of Indian Agriculture, a unique feature not yet found in actual practice anywhere else. The College farm can thus be utilised for such studies besides serving as a check to similar investigations by *kumars* on their own lands. It will also be a station for experiments of a practical nature and will serve as a guide for the *kumars* in similar work at their own States even after they leave the College—the liaison between them and the College will be permanently maintained.

The successful working of the preliminary scheme and its present amplification is in no small measure due to the fullest sympathy and support of Mr. M. G. Salter, M.A., Principal, Daly College, Indore, who took a very keen interest in it right from the very beginning.

APPENDIX A

Some extracts from the report of the Royal Commission on Agriculture.

"Where these schools contain a large proportion of boys from rural areas and have facilities for the provision of a farm or a garden, the addition to the curriculum of a combined course of practical and theoretical instructions in elementary agriculture of a rather more advanced character would, we believe, be productive of good results."

"We wish strongly to press the claim of the rural areas upon the time and interest of the best of India's youth. It is upon the homes and fields of her cultivators that the strength of the country and the foundations of her prosperity must ultimately rest."

"The object of these colleges is to qualify them to manage their own land and that of others. We consider, however, that more attention should be devoted to agricutural economics. More attention should also be paid to estate management.....should make the best arrangement they can to provide students with opportunities of gaining experience to estate management. Such experience will be particularly useful for students who propose to farm their own land or those of others."

"Colleges should initiate such courses and accept responsibility for creating a demand for them. Facilities should be provided to enable students to obtain further practical experience before commencing the active work either in the public service or on their own land."

"Here, however, we are concerned with the urgent need of instilling in rural communities the idea of leadership and service. It is their highest mission to develop in the student that public spirit and zeal for the welfare of his fellows which, when he goes out into the world, will impell him to take a full and active part in the life of the community in which his lot is cast."

"The opportunities open in India to men able and willing to play a selfless and patriotic role in the field of local leadership and of service to the public are unbounded. Such service is of the utmost value to the State."

APPENDIX B

Report on the work of the Imperial Council of Agricultural Research in applying Science to crop production in India.

SIR JOHN RUSSEL, D. SC., F.R.S.
Govt. of India Press, Simla.

Page 68.

"Better results would I think be obtained if instead of plots, an entire holding were used for demonstration supervised by a cultivator."

APPENDIX C

Expenditure and Income figures of the Daly College farm for the year 1936-37.

EXPENDITURE

		Rs.	a.	p.
1.	Farmer's wages	120	0	0
2.	Expenditure on implements	1	4	0
3.	Feeding of cattle	120	9	0
4.	Seeds for sowing	64	5	0
5.	Extra labour	63	2	9
6.	Miscellaneous	20	8	0
7.	Depreciation	32	8	0
	Total ...	422	4	9

INCOME:—(Receipts from the sale of crops and extra labour earnings.)

			Rs.	a.	p.
1.	Ground nut	... ...	56	5	0
2.	*Tuar*	... ...	23	10	0
3.	*Juar*	... ...	32	0	3
4.	Cotton	... ...	34	8	0
5.	Soya Beans	... ...	16	0	0
6.	Sugar cane	... ...	4	5	6
7.	Wheat	... ...	279	8	0
8.	Gram	.. ..	15	0	0
9.	*Urad*	... ...	2	8	0
10.	Miscellaneous crops	.. .. ..	10	6	0
11.	Receipts from extra labour	... ...	36	4	0
		Total ..	510	6	9
	Total savings of the farmer	... ...	510 422	6 4	9 9
		Balance ...	88	2	0

APPENDIX D

LIST OF IMPLEMENTS AND BULLOCKS

		Rs. a. p.		Rs.	a.	p.
1.	One pair of bullocks ..	..	..	120	0	0
2.	Two *bakhars* ..	... 6 0 0	each	12	0	0
3.	Two ploughs *desi* ..	... 5 0 0	,,	10	0	0
4.	Four yokes ...	... 3 0 0	,,	12	0	0
5.	Seeds drill four ...	... 5 0 0	,,	20	0	0

			Rs.	a.	p.		Rs.	a.	p.
6.	Two *dauras* malwi ...	...	3	0	0	,,	6	0	0
7.	Two Indora ridgers	...	4	0	0	,,	8	0	0
8.	One pair of chains	...	1	0	0	,,	2	0	0
9.	One bullock cart ...	...	60	0	0	,,	60	0	0
10.	One *kulhadi* ...	...	1	0	0	,,	1	0	0
11.	Four *nalchuda* ...	...	0	10	0	,,	2	8	0
12.	Six *perni* ...	...	0	2	0	,,	0	12	0
13.	Two *kusia* ..	..	0	8	0	,,	1	0	0
14.	One double *daura* ..	..	5	0	0	,,	5	0	0
15.	One *taraju* ..	..	1	4	0	,,	1	4	0
16.	One pair *tasla* ..	..	0	8	0	,,	1	0	0
17.	Two *pirani* and *alita*	..	0	4	0	,,	0	8	0
18.	Two *daranti* ..	..	0	12	0	,,	1	8	0
19.	Four *khurpis* ...	...	0	4	0	,,	1	0	0
20.	One lock ...	...	0	12	0	,,	0	12	0
21.	One *dantali* ...	...	0	5	0	,,	0	5	0
22.	One wheel-barrow	...	25	0	0	,,	25	0	0
23.	One fork ...	...	5	0	0	,,	5	0	0
			Total			..	296	9	0

Those who know Mr. H. S. Azariah who is now an instructor in the Allahabad Agricultural Institute will be glad to learn that his marriage to Miss Srinivasagam, daughter of Rev. Srinivasagam of Dornakal, took place on June 2nd, 1938.

THE WORKING OF GHEE SOCIETIES

S. N. Sanyal,

Inspector of Co-operative Societies, Etawah

Ghee is one of the most important articles of food in Indian dietary and it is consumed in large quantities on account of its suitability for cooking. It is generally prepared in U. P. by curdling milk, curdling the curd and then heating the butterfat thus obtained in an earthen or metal vessel on an open fire, and finallv cooling and straining it after the removal of water bv decantation.

Ghee making is an important supplementary industry to agriculture and is essentially a cottage vocation. Its organisation on sound lines is bound to improve the economic position of the agriculturists in substantial measure. In the western districts of U. P. ghee making, as a cottage vocation is of such importance that ghee merchants of Calcutta and Rangoon find it necessary to open branches or keep special representatives in some of the important ghee centres to ensure a regular and sufficient supply of the articles and we find a "Ghee chain" (if the expression may be used) stretching from Meerut right up to Cawnpore with important centres at Khurja, Chandausi, Hathras, Aligarh, Shikohabad, Sirsaganj, Etawah, Bharthana and Auraiya with offshoots in Gwalior State and adjoining districts. The importance of the ghee trade can be judged from the fact that Etawah alone sends out something like 40,000 mds. of ghee annually from its *mandi* (market) and a substantial portion of this go to Calcutta and Rangoon markets.

The ghee society is an attempt to organise this village industry on a co-operative basis so that the producers may derive the maximum of profit out of this business. Though in an experimental stage, it is pregnant with immense possibilities for the benefit not only of the producers, but of the consumers as well and would have far-reaching effects in ameliorating the condition of the agriculturists who form the backbone

of this country. For the first time organisation of ghee society was taken up in 1929 and the first society was registered on the 8th October, 1929, at Chaubankapura in Tahsil Bah, District Agra. Up to the 30th June, 1935, the organisation of the Ghee Society was confined to Bah Tahsil, where there are 66 societies and occupies the whole of the Tahsil bordering Etawah District. It has now been extended to Etawah District where there are now 45 societies and has tapped the most important ghee producing tract.

MEMBERSHIP OF SOCIETIES

Year.	No. of societies.	No. of members.	Quantity of ghee contracted in maunds
1929-30	1	16	25
1930-31	11	200	216
1931-32	19	310	417
1932-33	23	516	550
1933-34	29	660	800
1934-35	36	977	1182
1935-36	47	1397	1362
1936-37	111	3600	2800

The nature of business of ghee societies is such and the conveyances used (bullock carts or horses) are so slow that it is always convenient to have the societies within a radius of 10 miles of the centre to be created.

Nature of business.—The nature of business of the societies is collection and joint sale. For this purpose, a *Co-operative Ghee Union* is created to which all the ghee societies are affiliated and which works as an agent for the societies for collection and joint sale. The ghee is brought from all the societies to the union office in their canister either in carts (bullock) or pack horses and the ghee from each society is weighed and entered into the account books of the ghee union. If the sale of ghee is to be effected in Etawah Ghee *mandi*, then it is graded. If orders from consumers are in hand then the ghee is heated and cleaned

by decantation and tested and then tinned which are also sealed. When a large number of tins are ready, they are sent by bullock cart to the railway station and despatched to the buyers.

Constitution and membership.—The society is organised on the basis of "one village," one society. According to the usual rules, more than 10 owners of milch cattle (preferably buffaloes) join to form a society which is registered under "Co-operative Societies Act II of 1912". There is no share system, but every person joining the society has to pay an entrance fee of rupee one. The society elected their own *panchayats* (the executive committee) from amongst its members consisting of 3 or 5 members, one of whom is elected the *sarpanch* (president or chairman) and another is elected a treasurer (*khanzanchi*). A secretary is also elected from amongst the members by the *panchayat*, whose duty is to maintain all the accounts of the society. The *panchayat* manages the internal affairs of the society and are responsible for the maintenance of proper accounts. The committee is removable by the votes of the members in a general meeting and it has also power to fill up vacancies falling within the year. The committee is elected every year in the annual general meeting of the society and the retiring members are eligible for re-election.

The membership of the society is confined to one village. Any adult possessing milch cattle and residing in the village and conforming to the rules and regulation of the society can become member without any restriction for castes and creeds and it would not be out of place to mention that members enlisted from depressed classes (such as Chamars etc.) are the best repayers of ghee.

Staff, premises:—The societies have no paid staff. The *sarpanch* and the treasurer are honorary workers. The member secretaries are also honorary workers, but they may be paid some small honorariums. The members of the *panchayat* who do the work of weighmen of their societies throughout the year are also given small honorarium and

it has been generally found that the *sarpanches* of the societies take up the work of weighmen of the society. They are also the most active persons to bring round the villagers to enter into contracts with their societies.

The individual ghee society is affiliated to the Co-operative Ghee Union and it is this ghee union that has to employ staff for handling the ghee contracted by the members of the societies. The premises of the ghee union is generally stationed at a central place within easy reach where the ghee is sampled and treated. It has godown for storage of the ghee received from the societies and other stocks of the union. The premises have got stables for keeping the pack horses and the bullocks and a *pucca* oven for the purpose of heating the ghee. The Ghee Union gets the services of supervisors of the Co-operative Department. The ghee work in this district received last year, Rs. 6,000 from the Government of India for pay of staff. The Union has to employ several permanent hands throughout the year and a few temporary hands during the busy season from November to March. In order to manage the work of the societies, the Ghee Union maintains pack horses and bullock carts with bullocks. The expenses are met out of contribution from the societies as the union is not a financing agency and it has no funds of its own. The contribution is charged at so much per maund of ghee contracted by the societies (with their members).

All these duties are performed by the Ghee Union, but the preliminary work of entering ghee into the union is done every fortnight and weighing days have been fixed for each society. On that date the weighman of the ghee union go to the society with his tin containers and pack-horses or the cart. The ghee is weighed out by each member and put into the containers and after the weighing out by each member has been finished, the whole quantity is weighed again, put on the cart or pack horse and taken to the Ghee Union godown. In this way the ghee from each society is assembled. Then comes the question of treatment of the ghee thus assembled. If the ghee is sent to Etawah *mandi* for sale, *kachcha ghee* (that is untreated

and raw) is sent to the market for which no other treatment is given except that of mixing up the graded ghee to make it uniform. It may be mentioned here that grading does not pay in Etawah *mandis* as no consideration is given to higher grade ghee. In case the ghee is meant for supply direct to private persons or small merchants for supply to consumers, the ghee is treated in big open iron pans directly over fire, and then put into the decanter where it is allowed to cool down when the water and other impurities settle down in the bottom. The clean ghee is taken out through the stop-cock at the side of the decanter and the impurities through the stop-cock at the bottom. The ghee is tinned directly from the decanter which are then weighed and made into uniform weight and then sealed. They are then ready for despatch to the various buyers from different places. The ghee is sent to the railway station in the bullock cart belonging to the union.

Marketing and price fixing arrangement:—As has already been said above, *kachcha* ghee is sent to Etawah *Mandi* and the ghee sale there has to conform to the rules of the *mandi*. The ghee is sent to the *arhatia* (commission agent) of the union in the *mandi*. The ghee merchants of Etawah or the agents of ghee merchants or other places generally buy up the ghee. They visit all the shops of the *arhatias* in the *mandi* and buying the commodity according to their requirements and fix the prices on the basis of Calcutta quotations which are obtained daily. After the ghee has been bought by the merchant, it is sent to his godown and from there the sample from each tin is sent to the ghee testing laboratory where it is thoroughly tested and it is finally purchased if it passes the test. The ghee is then weighed in the godown of the merchant and after making various deductions for expenses, concessions etc. The price of the ghee is paid to the ghee union through the *arhatia*. The various expenses in Etawah *mandi* comes to about Rs. 2 per maund of ghee sold.

As for the prices fixed for supplying ghee direct to the consumers, the rates are the same as that of Etawah *mandi* for equal weights plus Re. 1 to meet the cost of heating and

classifying it (making free from all impurities, water etc.) A small cartage is charged for transportation to the railway station.

There is no dealing in the matter of contract with the non-member individuals as there are no consumers society, for the purpose.

Finances and Financial results:—The Co-operative Ghee Union is not a financial agency. The societies are financed by the Central Co-operative Bank of the District. The money is advanced to societies on pro-notes at an interest of 10 per cent per annum. Sometimes societies have raised small deposits for capital. The societies in their turn finances their own members. With money taken from the Co-operative Bank, the societies enter into contract with their members for a fixed quantity of ghee supply, generally from one to two maunds per buffalo and the rate is fixed at Rs. 10 to Rs. 12 per maund of 50 seers less than the Etawah rate. It is instructive to note that the *beoparis* contract at Rs. 15 to Rs. 25 per maund less than the Etawah rates. Again unlike the *beoparis* the contract money is given in lump sum and not in driblets which is seldom of any real use to the indigent *kisan*. There is no joint liability and the personal liability is limited to Rs. 50 only for outside debts. Sureties are taken to safeguard the money advanced.

No interest is charged for the advances to the members. The difference of Rs. 10 to Rs. 12 per maund between the market rate and the rate at which the societies contract with their members covers the interest charges on the money laid out, the management expenses and the creation of reserve and other funds and if after all this there is any saving, a small amount of "patronage refund" is given to members as an encouragement if they have honoured their contracts in its entirety. The financial results of the working of the societies may be put down in the following chart.

Year	No of Society	Quantity of ghee contracted in maunds	Amount advanced for contracts	Profit
1930-31	11	216	14692	172
1931-32	19	417	16524	2213
1932-33	23	550	23460	243
1933-34	29	800	28025	6514
1934-35	36	1182	34656	3970
1935-36	47	1362	49676	
1936-37	Figures not yet available.			

Advances to producers:—The advantage to the producers on account of which the ghee societies are a success in contrast to the ways of the ***beoparis*** (small ghee merchants) may be summed up as follows.

(1) All the members are accorded square dealing and equal treatment in the matter of ghee contracts, irrespective of caste or creed as is never done by the *beoparis.*

(2) Its democratic management. All have got one vote each. The elected ***panchayats*** manage the affairs of the societies and every member can have his say in the affairs of his society.

(3) Payment of contract and feed money in lump sums and in cash which enable the ***kisans*** to meet their obligations.

(4) Patronage refund for the full delivery of the ghee contracted. It is one of the most important factors for success.

(5) Reasonable rates of contract and correct weighments.

(6) All transaction are made in the villages itself of the members and none have to go out to other villages.

1. ***Advantages to consumers.***—Heated and classified ghee (***i.e.*** free from water and other impurities) is supplied to the consumers.

2. Unadulterated and pure ghee of high quality at reasonable rates is supplied in properly soldered tins direct

from the Ghee Union office thus eliminating all middle men profits.

Business aspect profit or loss.—The result of the working of the ghee societies during the last 6 years has conclusively shown that there cannot be any financial loss if they are worked with a little care and if there is no mismanagement or theft. In the year 1932-33, there had been an abnormal drop in ghee prices and even then the net profit was Rs. 243. With a little more caution in the matter of ghee contracts, it can be made a safe business for the *kisan.* The advent of the ghee societies in Bah and in Etawah has given an invisible profit to the cultivators in the shape of higher contract rates which are now being offered even by the *beoparies* (ghee merchants) in order to compete the societies which generally offer better rates for ghee contracts. In 1929 the difference between the rates of ghee contracts offered by the *beoparies* used to be Rs. 15 to Rs. 25 less than the Etawah *mandi* rates. Since than the difference has come down to Rs. 8 to Rs. 10 per maund of ghee contracted.

Then there is the "Patronage Refund" for the members which is an extra income for them which previously used to go to the pockets of the *beoparies.* Except for the year 1932-33 the societies had been steadily giving "Patronage Refund" to their members at the rate of Rs. 2 to Rs. 5 per maund of ghee repayment which works up to 5 to 12 per cent. rebate when the rate of contract was Rs. 40 per maund.

Other functions of the Ghee Societies.—The first work that was taken up by the ghee union was the supply of feeds to the milch cattle. Instead of paying when in cash, cotton seed were supplied to the members for the feeds of their milch cattle. Arrangements have also been done in taking a census of milch cattle yielding milk seven seers or more per day with a view to introduce cattle breeding by selection and elimination of poor milkers. Introduction of better breeds of buffaloes has also been taken up and some buffaloes of Dholpur Breed have been obtained and given to the best members. They have been kept under observation and if they prove suitable for the tract, more would be obtained and given to the members.

The Ghee Union also maintain buffalo bulls of better breed for breeding purposes. It may be mentioned here that a former bull did not serve the buffaloes of this tract well and it seems that Murrah buffalo bulls are not very suitable for the she buffaloes of the local breed.

It has been proposed that the following functions should be taken up by the Ghee Union: (1) introduction of silage and (2) arrangement for veterinary assistance. For the latter, proper authorities have already been moved. It would not be out of place to mention that establishment of a veterinary hospital or the services of a veterinary assistant cannot be secured without financial aid either from the Government or from the District Board.

Description of the working of a Ghee Society.—The system of working of the ghee societies is simple. The society is organised on the system of "one village, one society." According to the usual rules more then 10 members who keep milch cattle (mostly buffaloes here) join to form a society. There is no share system, but any person joining the society has to pay an entrance fee of one rupee. The society elects its own ***panchayat*** from amongst its members which manages the affairs of the society with the help of the supervisor in charge. As soon as a cow of a member calves, the society enters into contract with him for a fixed quantity of ghee supply, generally from one to 2 maunds per buffalo. The rate is fixed at Rs.8 to Rs.12 per maund less than the Etawah market rate, in contrast with Rs.15 to Rs.25 less per maund given by the ***beoparis*** (small ghee merchants of the villages). The margin of Rs.8 to Rs.12 covers the interest charges on the money laid out, the management expenses and the creation of reserve and other funds. A small patronage refund is also given to the members, if there is a saving after meeting all the obligations of the society. The whole of the contract money is paid to the member in a lump sum which is very much appreciated by them as the ***beoparis*** pay them in driblets or in kind much to the loss of the members. The society is financed by the Central Co-operative Bank of the locality of which the societies purchase one share each to conform to

their rules. The money is borrowed by the societies from the bank by the execution of the usual Co-operative Societies pro-note like that of the credit societies and pay an interest of 10 to 12%. Sometimes societies have raised small deposits for capital. The member on their part execute an agreement in favour of the society for payment of ghee after they have received the contract money. In this agreement mention is made of particulars of the contract as to the quantity and rate of ghee and the amount of money paid, and penalty for non-delivery or adulteration of ghee. The milch cattle, the ghee yielded of which is contracted, is hypothecated with this society and the agreement gives full description and particulars of the animal in question. There is no joint liability for the members for outside debts of the society and the personal liability of the individual is limited to Rs.50 only for such debts. Sureties are taken in these contracts. The members go on weighing out ghee for the whole of the milking period of the milch cattle, but the contract period is generally limited to a period of one year. There is no time limit for contracts and it goes on all the year round though the greater portion of the contracts are entered into between the months of August and January. The rate of contract varies with the day to-day rate in the Etawah market. Some times the indigent members have not enough to feed their milch cattle and the society accommodates them with small loans for feed money, limited to Rs. 8 to Rs. 10 per maund of ghee contract. On this interest at the rate of 15 per cent. per annum is charged. At the time of the next contract this loan together with the interest is deduced from the contract money and the remainder paid. Contrast this with the method of the *beoparis* who pay in kind charging any rate they like for the article supplied. If any member fails to deliver the whole quantity of ghee contracted, *sawai* of ghee (*i.e.* 25 per cent more) is charged and is added to the demand and remains unaffected by the changes in the market rates whereas the *beoparis* sometimes charge *sawai* of the price then prevailing and sometimes the actual price of ghee at the cessation of weighing plus 24 per cent. interest whichever suits them best and which varies according to the market rates.

Besides the central co-operative bank, which acts as the fianancing agency, the societies have federated themselves into a *Central Co-operative Ghee Union* to which they contribute a small amount per maund of ghee contract. The chief functions of this union are to arrange for collection and sale of the ghee of the societies and to consolidate and unify their working. This contribution from societies goes towards defraying the expenses of the staff employed by the union for collecting ghee from the societies and for blending, grading, heating, classifying and transporting the same.

The actual working of these societies has also the merit of being very simple. The ghee is weighed out every fortnight by a member of the *panchayat*, usually the *sarpanch*, and there are fixed dates for each society. The members gather, bringing their ghee with them, in the *chaupal* (sitting room) of the *sarpanch* of their society with the weighman of the Central Co-operative Union in attendance with his tin containers and pack horse or cart. The weighing is a full dress affair. One of the members of the *panchayat* but usually the *sarpanch* weighs out the ghee of each member and puts it in the tin containers brought from the union, and the ghee account of the members are made up then and there and verified by oral questioning, and entered in his pass book. The weighman and members keep an eye on the balance and the *panchayat* is not neglectful of its duty of seeing that correct measure is given and that the ghee is of proper standard and is not adulterated. If it is of very low standard or adulterated, it is rejected. If it is not up to the standard it is heated and decanted and clean ghee taken. The Co-operativeinfluence coupled with the *panchayat's* watchfulness is responsible for the surprising fact that in all these years there had been no instance of adulteration with any foreign matter (such as margarine or lard). There were one or two instances of adulteration with milk or whey, but deterrent punishment put a stop to all that. When all the ghee has thus been weighed it is handed over to the weighman of the union who weighs it again and signs the proceeding of the society by way of giving receipt. The weighman then takes it to the godown of the union where it is weighed over again and a receipt given to the society duly signed by the

supervisor who is also the honorary secretary of the Ghee Union. All the ghee thus gathered in the union godown is graded as soon as sufficent quantity is collected and despatched to the Etawah *mandi* (as *kachcha* ghee) in the Union's own bullock carts. If it is to be sold to the consumers direct or to such small traders as deal directly with the consumers, it is heated, classified, tinned and sealed before being despatched. This is also transported in Union's bullock cart to the railway station. Hired carts are very seldom used.

At the end of the year, the balance sheet for each society is drawn up. If there is profit, it is divided according to the bye-laws : ¼ of the total profits goes to the Reserve Fund, ¼ of the remainder to the Bad Debt Fund and ½ of the remainder to "Patronage refund" and the remaining as honorarium to those members who have worked for the society, to secretaires and towards the creation of other funds, such as charity fund, village improvement fund, cattle improvement fund, etc.

The bye-laws provide for the creation of the post of the member secretaries for each society to maintain its accounts but it has not worked well as the accounts of the ghee societies are fairly complicated and the number of transactions fairly large, for a member secretary to manage. Necessity for appointment of separate accountants for the societies was felt more and more and now the ghee union appoints the accountants for the societies.

A glance of the profits made by the societies, their membership and the quantity of ghee contracted mentioned under the Head Finances and Financial results, clearly reveals that the societies are quite successful. So far only 3 societies are unsuccessful, and it was due to the opposition of the more influential *beoparis* of the locality as well as in the members who were afterwards found to be small ghee dealers or sell their ghee for cash. The success of the ghee societies can also be gauged from the fact that more and more villages are approaching the authorities to open new societies.

Summary and Observation.—The working of the ghee societies clearly prove that the production and sale of ghee

can be modernised. Though these societies cannot claim to have achieved much, yet they have paved the way to greater expansion and have already shown that it can add a few more rupees to the meager income of the *kisan*.

There is so much yet to be done. Take the example of ghee-heating. The present system of heating is unscientific; a little inattention spoils the flavour and affects the vitamins; and it is time that some research workers evolve a system of scientific heating to keep the flavour and the vitamins of the ghee intact.

Another work that has to be done is to evolve such a system of working these societies as to be able to reach the ghee direct to the consumers.

Side by side with the Co-operative Ghee Societies, the work of milk testing combined with cattle breeding to improve not only the milk yield but also the breed of cattle can be taken up. Experiments about tinning require attention.

In order to protect the ghee industry, it is urgently necessary that some law should be passed to prevent adulteration. The verdict of the Legislature (Assembly) of the country is against the stoppage of import of margarine or fish oil; but it can at least pass law making it incumbent on all importers of fish oil and other adulterants of ghee to have them coloured differently from ghee. If this is done, it would give the ghee industry enough fillip so as to put it on a sounder and firmer basis.

It may also be mentioned here that the ghee societies should be organised away from large cities in order to make them a success and this would give the distant village folks an occupation and a source of income.

"I think it is fair to say that intelligent use of the land is the first criterion of any civilization."—*Prof. R. S. Tugwell.*

BLAZING THE TRAIL FOR SISTER INDIA

Through the Farmers' Fair at the Agricultural Institute, Allahabad

WALTER G. MENZIES

Pendra Road, India

Of all countries in the world, it can truly be said, that Sister India is a country of contrasts. One of the strangest of them being the stark poverty of the starving industrious peasant, and the sleek impudence of the lazy improvident beggar that masquerades as a holy man, and lives comfortably on the charity of the most needy nation on earth.

It is said that, "the Unchanging East still abides", and in some things this is true; but one has only to notice the hem of Sister India's garment to realize that she is being led to walk in the paths of progress that her fore-fathers thought impossible. If India has been reclining on a civilization of nearly two thousand years before Christ, one has to note that she is stirring herself, looking around, stretching her feet, feeling for the best paths in which to travel. The hand of Western friendship has been taken hold of by the hand of Indian courtesy and together they are walking, talking and planning regarding those things that bring about a real transformation. It would be impossible to enumerate all the things that have helped to bring about these transformations, and while we make mention of the postal system, telegraph, railways, education and irrigation, I think that we have to acknowledge that Agriculture is contributing in a very large degree to the transformations taking place.

One cannot but be impressed with the changes that are being brought about by means of Agricultural education and demonstration. It must be so in this land of India. There is no escape from it. At the top of the list stands the farmer class of people in the census returns. He is the poorest of the King-Emperor's subjects, his average earning

being ten pice a day, but some would put that at six pice a day. This land of India could not be called the Golden East without the Indian farmer for a great deal of the revenue of the country is extracted from his pocket.

It was the privilege of the writer and his wife to visit the Farmers' Fair at the Agricultural Institute, Allahabad, through the kindness and courtesy of Dr. S. Higginbottom and Mr. and Mrs. Mason Vaugh. The object for which the Fair has been organized is winning its way and accomplishing its purpose. The three impressions that were made on my own mind as I passed through the various sections of the Fair were these: Educate, Illustrate and Demonstrate. From the Staff and student body of the Agricultural College, they had experts along the various lines of agriculture. Lectures were given as to how to select the best seed grain, preparation of the soil, different ways and means of fertilization, illustrated lectures on how to produce better stock, the bettering of the milk strain of cattle and the raising of better work oxen—everything that enters into the better and best methods of agriculture. The fine display of grains, flowers, vegetables, were to the writer most interesting and shewed the great interest being taken by the rural farming population in the Fair which is but only six years old.

The booths shewing the model village with every convenience, also the contrast of homes in which the old midwifery method is still being carried out compared with the nice tidy way of taking care of the new born child when it comes into the home was one of the finest demonstrations that could have been given to the large numbers visiting the Fair. What an illustration along hygienic lines for the Indian fathers and mothers.

I was tremendously enamoured with the handicrafts' section under the supervision of Mrs. Vaugh, where the fine basket-weaving industry was on display. Here was to be seen some real work of art in the basket weaving handicraft. Great credit is due to Mrs. Vaugh who has in these villages sponsored this fine piece of work and the way they have responded to her plans and suggestions have been remarkable. There was some real art work on those baskets and other

materials shewn. This is one of the ways in which the village people can help their economic condition and that without much outlay in the way of capital to begin on.

In this section also there were a great deal of hand woven and hand embroidered work, some of this being done by the students and others by the village and city people, all of which was most interesting and, to onlookers, inspiring.

The demonstration given regarding the making of jams and jellies and that in an inexpensive way must have made its appeal to all who witnessed the same. It was a fine illustration of how cleanly such work can be carried on.

The fine Social fellowship throughout the Fair was very marked and the fine spirit of friendship shewn by the Staff and students was a very delightful part of the whole Fair.

Everywhere could be heard expressions of amazement as the great crowds passed through the various sections. The injunction to all seemed to be handle, taste and see. What a fine display of turnips, cabbage, cauliflower, vegetable marrow, lovely and delicious tomatoes with a beautiful blush on their cheeks. Then it looked as if someone had actually "spilled the beans" for some of the shelves were filled with beans galore. I will say that it took keen experts too in making decisions in the judging of the various articles in these sections.

It was of great interest to see the fine show of milk buffaloes and cows as well as the bulls among the cattle. Here to me was one of the finest helps to Sister India in making or in helping to solve one of her greatest problems namely the production of cattle that are worth while.

I shall always retain in my mind that great audience that listened to the Radio and also to the addresses that evening through the loud speaker and the fine movie that was given by Mr. Mason Vaugh, of various phases of the Agricultural work on the Farm and in the Institute.

Thus is the Farmers' Day in the Agricultural Institute in Allahabad, helping tremendously to "Blaze the Trail for Sister India."

REPORT FROM THE DEPARTMENT OF AGRI-CULTURE, UNITED PROVINCES

FOR JANUARY, 1938

I—Season—The rainfall during January, 1938, was general, 29 districts reporting above normal. It was comparatively heavy in the 1st and 4th weeks, while lighter in the 2nd and 3rd weeks. Taken as a whole, the total rainfall of the month exceeded the normal except in parts of Lucknow and Fyzabad Divisions and a few other districts. It was beneficial to the standing crops, but where it was accompanied by hailstorm it damaged the crops to some extent.

II—Agricultural Operations—Agricultural operations are well forward. Preparations of land for sowing sugarcane and extra crops is in progress. Irrigation of *rabi* and pressing of sugarcane continue.

III—Standing crops—and *IV—Prospects of the harvest*—The condition of standing crops is generally satisfactory and prospects are favourable.

V—Damage to crops—Damage to crops by hailstorm is reported from certain villages of Meerut, Agra, Mainpuri and Budaun Districts, while hailstorm and frost caused slight injury to crops in a number of districts. Arhar suffered most as usual.

VI—Agricultural stock—The condition of the agricultural stock is reported to be satisfactory. The following figures furnished by the Director of Veterinary Services, United Provinces, show slight increase in cattle disease as compared with the previous month :

Disease	December, 1937		January, 1938	
	Seizures	Deaths	Seizures	Deaths
Rinderpest	1,595	840	1,642	869
Foot and mouth	1,342	17	1,515	22
Hæmorrhagic Septicaemia ..	106	18	146	116

VII—Pasturage and fodder—Fodder and water are sufficient everywhere except Muttra, Agra and Hamirpur Districts, which report fodder scarcity in some tahsils.

VIII—Trade and prices—The prices of chief food grains show a tendency to rise as compared with the preceding month, except in the case of wheat and barley whose prices have fallen slightly.

The following figures compare the average of retail prices in rupees per maund with those of the preceding month :—

	End of December, 1937	End of January, 1938
Wheat	3·543	3·407
Barley	2·313	2·283
Gram	2·415	2·432
Rice	3·984	4·000
Arhar dal ..	4·920	5·025

IX—Health and labour in rural areas—Condition of labouring and agricultural classes is satisfactory. Plague and small-pox are reported from certain districts.

Give me the money that has been spent in war and I will clothe every man, woman and child in an attire of which kings and queens would be proud. I will build a schoolhouse in every valley over the whole earth. I will crown every hillside with a place of worship consecrated to the gospel of peace.—

CHARLES SEEMAN.

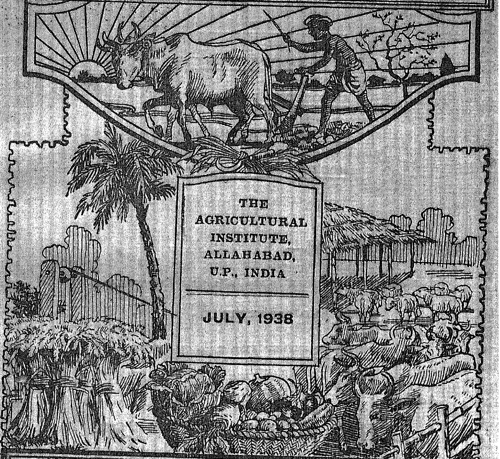
VOL. XII] [No. 4

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life

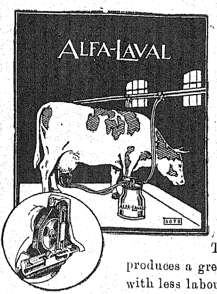


THE AGRICULTURAL INSTITUTE, ALLAHABAD, U.P., INDIA

JULY, 1938

"No nation has ever achieved permanent greatness unless this greatness was based on the well-being of the great farmer class, the men who live on the soil; for it is upon their welfare, material and moral, that the welfare of the rest of the nation ultimately rests."

THEODORE ROOSEVELT.



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DAIRY FARM P. O. :: :: :: :: :: ALIGARH, U. P.

Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer,
Allahabad Agricultural Institute.

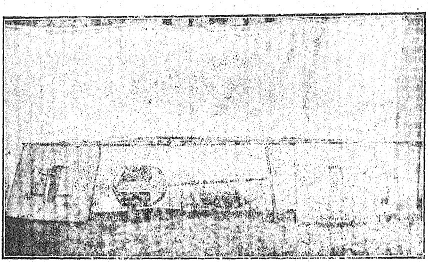
Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by $3\frac{1}{2}$ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the shear broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility and sanitation, and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE

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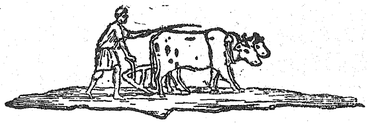

VOL. XII] JULY, 1938 [No. 4.

Editorials

The All-India Cattle Show

The proposal to hold the All-India Cattle Show again next February in order to maintain the interest created by the first All-India Cattle Show held in Delhi last February, is to be welcomed by all who are interested in the welfare and improvement of cattle in India.

In spite of the fact that the southern portion of the country was not well represented in the last show, every one who visited the show must have been greatly impressed by the fact that India possesses such a wonderful collection of different breeds of cattle. It just shows the potentialities of livestock improvement even with the existing breeds that the country itself possesses. It is therefore hoped that elaborate arrangements would be made to bring together to the next show all the breeds available in this country in order to make it more instructive than even the last show had been.

The last show was also very helpful in bringing together breeders from different parts of the country, thereby making it possible the exchange of ideas which is very essential for getting co-ordination of theories and opinions in the fields of

animal breeding and cattle improvement in this country. A well-organized conference, in connection with the show, of men engaged in animal husbandry and dairying, in our opinion, would be a great asset in getting considered opinions discussed and thrashed out in public. There are in this country too many loose opinions about cattle breeding and cattle improvement in general. Such a conference therefore, in our opinion, would help greatly towards a better understanding of the problems of cattle breeding and cattle improvement in this country.

In connection with the show we would also suggest that popular lectures by experts in animal husbandry and dairying be organized, so that those who are interested in these problems and who as we saw this year came from different provinces and States, mostly of North India, would feel more amply repaid for having gone so far to visit the show.

We felt that the show this year was very worthwhile and we would urge all those farmers and agriculturists who can do so to visit the next show when it is held.

The Soybean

This crop is not well known in this country, although it is one of the most important crops in China and Japan and has been used in those countries from time immemorial. However the crop is not altogether foreign to this country as it has been for a long time one of the most important food crops of the people of the Hills of Assam, Bhutan and Nepal. More recently however the crop is being popularized in the plains of India, one of the sponsors being Mahatma Gandhi himself. We would like to say that the crop deserves more consideration in this country than it has heretofore, because of its very many valuable qualities. In the first place it has been found that the seeds of this crop plant contain some of the most valuable food materials which the human body needs. "As compared with most vegetables, they have unusually large amounts of protein, fat, calcium, phosphorus, and iron. Cooked immature soybeans proved to be a very good source of vitamins A, B and G, and a poor source of vitamin C" (C.D. Miller and R. C. Robbins: J. Agr. Res. Vol. 49, p. 161, 1934). Soy-

bean milk has received a great deal of attention in America recently where its use is being recommended not only for medical purposes, but also as a substitute for cow's milk. In fact it is commonly believed wherever this crop is grown and consumed that the soybean probably has no peer as an economic source of valuable and wholesome dietary elements. As early as 1915 it was discovered by an American doctor that soybean flour is of great value for feeding children and is readily digested.

When this country is trying to find out steps in order to make food supplies and especially protective foods available at prices within the reach of all classes, we would recommend this crop to the very serious consideration of the nutrition experts of this country and to see whether this is not the food crop to which the taste of the people of this country should be accustomed.

The crop plant is also a fairly good fodder and may also be grown as a nitrogen supplier to soils which are depleted of this very important food constituent for other crop plants.

The soybean has also various other uses, that it is now very difficult to enumerate all the uses to which the product of this plant are now being used. One of the reasons for Japan taking over Manchuria and also for invading China has been attributed to the fact that Japan wanted to get the control of the soybean and its products in those countries.

The Premier on Rural Development

In the course of a speech which was delivered in the Rohilkhand division ural development conference held during this month, the Premier made certain very striking remarks, with the sentiments of which we fully agree. We therefore reproduce them here so that the sentiments expressed therein will reach those who, like us, have been working on rural problems and who have sometimes met with apathy, indifference and hopelessness, so that they also, like us, would feel encouraged when we know that the head of the province is heart and soul with us in our programme of rural uplift. He said in part:

"In reality a state has no right to exist if it cannot effectively and successfully contribute towards the moral and material advancement of the people committed to its charge. Our duty in the case of the rural folk is still more real and unescapable. It is they from whom everybody gets his own means of sustenance. Strange it looks but it is perfectly correct and true that but for the help that we get from them, but for the taxes that we realise from them the state would collapse any moment, as you know, most of our revenue is derived from the rural people.

"The aspects of rural development problem are numerous and its scope unlimited, we need the assistance of everybody whom we can persuade to come to our assistance in this respect.

"There is no reason why zamindars and tenants, why Congressmen and non-Congressmen, why officials and non-officials should not be able to work together in the performance of those duties which I regard as nothing less than sacred.

"Agriculture is the main industry of our province. Ninety per cent of our people live in villages and at least three out of four derive their maintenance and their sustenance from land itself. So naturally agricultural advance, agricultural co-operation becomes the pivot on which the fabric has to stand. If we can raise agricultural output by say, about ten per cent we will be adding something between 8 to 10 crores to the wealth of the province. We have to do all we can to promote industries, but even if we take up a number of key industries and have around them an equally large number of smaller industries, these put together, will not bring us six or eight crores now or even after decades. So what we can easily achieve through proper attention towards agriculture will be much more than what we can otherwise achieve through other means. The other means too we do not intend to overlook or ignore. We will do all we can but in an agricultural community the best means of approach has been through agricultural advancement.

"Along with this we have the scheme of marketing societies and it is also necessary to improve the breed of cattle, for even the use of modern implements depends on the energy that can be supplied for working, and unless you have a good breed of cattle, you cannot expect the villagers to make use of heavy implements. Also we want to raise the standard of life to see if dairy produce, milk or ghee can be made available for the villager's children. For that too we shall do all we can to improve the breed of cattle.

"But that is not enough; we have to make life more cheerful and they must have at least some occasions when they may get some little joy in life. For that we must provide entertainments of healthy type and physical exercises, *dangals* and sports; other means will have to be introduced.

"But the key to all this has to be found in the moral foundation on which alone the entire fabric can be built. The villager has to learn the principle of self-help, he has to change his outlook and we have to give him the necessary instruction in this line."

Greeting his pupils, the master asked:
What would you learn of me?

And the reply came:
How shall we care for our bodies?
How shall we rear our children?
How shall we work together?
How shall we live with our fellowmen?
How shall we play?
For what ends shall we live? .....

And the teacher pondered these words, and sorrow was in his heart, for his own learning touched not these things.

(*From 'Principles of Education' by Chapman and Counts, and quoted in the Moga Journal.*)

THE SIGNIFICANCE OF RURAL PEOPLE TO GOVERNMENTS *

By Henry C. Taylor

Director, Farm Foundation, Chicago, Illionis, Recently American Representative, International Institute of Agriculture at Rome.

In looking over the subject which has been assigned to me, I have been somewhat puzzled as to the best approach, but very much more puzzled to know just how to make my presentation and bring it to a close in such a way as will be significant from the standpoint of this group. I was much interested in the statement regarding the number of agricultural missionaries at the present time, which was made this morning. It seemed to indicate either a change in standards on the part of Mr. Reisner, or else a reduction in the numbers of ; gricultural missionaries in the field. I suppose it is a matter of change in standards, if he is going to put them on the preferred list.

My interest in agricultural missions is by no means new. It was back in 1895, forty years ago, that I went to Lake Geneva and sat under Dr. Mott and received an inspiration from him. In those days, Mott and Spoor were just as dynamic as Dr. Mott is today, and they made a profound impression on the young men wh) gathered at the Y. M. C. A. camp at Lake Geneva. At that time, I was a student at the Iowa Agricultural College. Believing that Mott's view of life was correct, and that we should dedicate ourselves to a real purpose, there were some of us who thought then that the field of agricultural missions might be developed. Though I do not know that Dr. Mott know it, there was a group of three of us—one who was studying medicine, one who was studying for the ministry, and one an agriculturist—who

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decided that we would go out as missionaries, in a group of three, and take up the three aspects of missions. But that was in the winter of '95-'96 and there was no demand. Now I am saying this in order to raise the question as to whether the reason there are only fifty agricultural missionaries in the field today is because this is the limit of the demand. The question I raise is whether or not the difficulty is with those who are doing the sending or those who are willing to be sent.

In figuring on the approach to make to this subject this morning, I have kept in mind the same ideas we had in mind, so far as the agricultural work was concerned, when as a Laymen's Commission we arrived in India in the autumn of '31. At that time we felt that the natural approach to studying agricultural missions in India was, first, to know what the problems of rural India were, and then to know in what measure the indigenous agencies were meeting those needs, in order that we might properly appraise the need of agricultural missionaries to supplement that which was being done by others.

There has never been a time when governments were taking more interest in rural people, or rather I should say there never was a time when governments were taking more interest in agriculture, than at the present time. I think you will see the difference between these two statements. You know what the situation is in the United States. What you do not know Dr. Baker is going to tell you later, so I shall not indulge in any statements in regard to the United States. I wish to talk some about other governments, other than India, China, and Japan, because of the tremendous amount of energy that is being given to the question of agriculture in the various countries of the world.

Our primary interest is in motives which have led to the new interest that governments are taking. In the main, the motives may be classified as economic, political, or military. Well-being is sometimes less desired than power. This may have grown out of the fact that at the close of the World War, a continued armistice was negotiated instead of a treaty

of peace. And, as a result of that continued armistice, all of the countries of Europe have felt that they must be ready for the next world war, or the re-breaking out of the old one.

On the other side, with respect to the motivation of this greater interest, is a greater consciousness on the part of agricultural groups themselves. Rural people, farmers of the different parts of the world, have become more class conscious. Agricultural people of the world have been among the last to take on a class consciousness that looks towards a fight for the rights of the farmers themselves in the inter-group struggle that exists in the various countries. It was more than forty years ago that an American economist by the name of Sparr, in writing on the distribution of wealth in the United States, said that the next great struggle will not be between geographical areas, but between classes, it will not be between the North and the South, but between country and city.

A part of the increased interest on the part of governments is a political interest. It is in part a military interest; in part it is a broad, general economic interest; in part it is the resultant of the knocking at the door of government by another class group, a pressure group, being brought forward from the country, in a measure to counterbalance the pressure groups from the other side. I believe it is important to bring out this fact, and to inspect all the motivations in the movement on the part of governments with respect to their interest in agriculture, because the character of the motivations has much to do with the character of what is done, and the fundamental significance of what is done, from the standpoint of building higher rural civilizations. My pessimism is aroused when I think how little governments are doing in these days in the way of building higher types of rural civilization as distinguished from what they are doing, seemingly, to satisfy the demands of a more or less militant agriculture on the one hand, and on the other hand, the building up of an economy that will be most serviceable in the next war.

Many of the activities that have been carried on by governments during these recent times have to do with the

restoring of the incomes of farmers to levels comparable with the incomes of other groups; that is, regaining for agriculture, prices for its products comparable with the prices of the things farmers buy. Whether you study the European countries or the countries of the Southern Hemisphere, you find a common desire to get something more for agriculture in the inter-change of agricultural products for industrial products. This has been true because of a felt need for restoring the balance of purchasing power between agriculture and industry in the various countries of the world. This need for a balance arises out of difficulties in international trade. The fear is that these may militate against an adequate world peace and an international economy whereby the basic principles of a world economy can be worked out. The struggle for better prices on the part of agriculture is particularly noticeable in the European countries where industry over-balances agriculture. It has been relatively easy to stimulate agriculture in those countries that are more largely industrial by simply making it difficult to bring in agricultural products. The tariff on imports was the simple method of increasing the prices of grain and other agricultural products in the countries that had a deficit; and even in the countries like Holland, where they had an agricultural surplus, they found it relatively easy to maintain prices at home far above those they got abroad. While in Rome, I was able to import butter from Holland without paying any import duty, so that I was paying about one-third as much, after paying the postage, for the butter I was eating at my table as the citizens of Holland were paying for butter purchased in their own country. They were maintaining prices at home and reducing prices on exports; but by this means, as the agricultural population was small relative to the industrial population, the high domestic price was absorbed to the benefit of the farmers.

The countries of the Balkan States, or the countries of the Southern Hemisphere that are primarily agricultural, used different methods to increase the incomes of the farm population. The method most used was that of inflation—reducing the value of the money unit at home in order that the

farmers got more of these money units for their products, even though the same products were being sold for the same prices in gold in the world market. Both of those major techniques, that of protection in the countries where there is a deficit, and that of inflation in the countries where there is a surplus, are not a part of true world economy. So far as inflation is concerned, this method cannot possibly be continued. The effects are only temporary.

Now when we get down in somewhat more detail to some of the more concrete things, besides these questions of prices, that are being effected in these European countries, in particular with regard to the rural people, we find, for example, a very interesting movement in Germany which may or may not be too closely tied up with the war motivation. I remember when I was taking a course of lectures on Agricultural Economics in Germany in 1900, one of the reasons given for the desirability of small farms in great numbers was that the farm was the best possible breeding ground for soldiers. And, within fourteen years after that time, they called for the soldiers.

At the present time, there is a good deal of thought being given in Germany to the revival of the old peasant customs: I remember when Dr. Baker and I were visiting in Germany in 1934, they had a nicely staged pageant especially for our benefit. And here and there in the country we noticed the carrying forward of festivals in which costuming and folk dances were being brought into prominence for the entertainments of rural peoples.

You have heard about the book entitled, "New Nobility Out of Blood and Soil," written by the Minister of Agriculture of Germany, and the fact than in Germany to-day many people of higher class are putting the term "Bauer" before their names; that is, "*Farmer* John Jones." The belief is that a new dignity is being given to the agricultural people of Germany at the present time, the full significance of which I am not in any way able to pass upon because of the complexity of the motivations in that country at the present time. They are at the same time doing other things. They

are extending electricity into the country and are spreading educational and vocational information.

In France, the major movements have been for increased incomes for farmers, and these have gotten to the stage where many of the farmers of France are finding it difficult to sell their wheat because they have been over-producing and have become exporters of wheat instead of importers, and the protective system had to be supplemented by some means of getting rid of the surplus. They got rid of the surplus wheat by denaturing it and having it fed to the livestock. Along with this has come other things. The number of communes supplied with electricity rose from 7,500 to 35,000 in the after-war period. All of France is divided into 38,000 communes for administrative purposes, each of which is a little larger than one of our townships. Of these, 35,000 are supplied with electricity at the present time. About 9,000 communes have received subsidies for improving their supplies of drinking water, showing that there has been an interest in these physical elements, at least, of the standard of living.

The standards of living of the peasants of the greater part of Italy are more nearly comparable to those of China than any other part of the world I have visited. But, some things have been done in recent years. Marsh lands have been brought under cultivation, and sanitary homes provided for the families on the reclaimed land. Grazing land such as that of the plains about Rome have been brought under intensive cultivation by deep plowing which breaks up the hardpan. They have been able to make a new agriculture in the Campagna Romana, and with it has come a great improvement in the life of the people, and particularly in the numbers of people that could live fairly well. There is near Rome a 2500 acre estate. Formerly, six shepherd families came to graze their sheep on this land each winter. They paid rental to a Prince in Rome. Recently that area has been converted into a dairy, fruit and grain farm, under the management of a competent man, and in 1934 the estate was supporting sixty-five families. A high class school and modern homes were provided for the people on this great estate. The

milk from two hundred cows was going into Rome every day. It was a tremendous change, and much of this sort of thing is going on. One of the motives was to find place for a growing population. We were no longer taking into the United States the former quotas of Italians, and the surplus population had to find an opportunity somewhere, and here was one way to do it.

The clearing out of the mosquitoes and the putting of the land into condition for agricultural use, the building of modern homes for farmers, with every window screened against mosquitoes—(the mosquitoes were so bad in this area that during the period when they were being eliminated with the people had to go into their homes when it was dark, and stay there, in order to avoid inoculation with malarial fever)—was a significant movement from the point of view of providing home for people.

With regard to motivations, up to January, 1935, one could look upon it from the outside and feel that the rural people were being considerably benefited, and could see no ulterior motives beyond the desire that these people should have a higher standard of living. The relation between landlord and tenant was improved materially. A greater security was provided for the tenant farmer.

In Spain, prior to the revolution, there was an agricultural movement started by college students who went into the rural areas and acquainted the people there with the classic works of art. One of the things that impressed a friend of mine who spent a good deal of time in Spain, and who gave me this particular point, was that there was a quick response on the part of the rural people, that the æsthetic sense was being aroused. This was a popular movement, assisted by the Government; it was not simply a student movement—it was carried forward by Government aid.

In regard to Russia, the situation is one where agriculture, not rural people, is given thought and attention. Many rural people have actually been destroyed in the interest of a city proletariat that is endeavouring to supplement its

industrial programme by getting food supplies with little regard for the welfare of the rural population.

Perhaps I have given too much attention to the situations in the Occident before turning to the Orient, but it would seem that West must put its own house in order if it would make the maximum contribution to the East. There remains an important supplementary function to be performed by home missionaries in reshaping motives, if the West is to build a rural civilization possessing a culture Christian in quality.

It is with some hesitation that I turn again to India, China, and Japan. The things that the Laymen's Commission had to say back in 1932 are much more fresh in my mind than the things that have happened in these countries since. As I look over the situation in India and Japan and note the great amount of Government activity in agriculture which exists in these countries, the Agricultural Colleges, the research work, and the extension service, at least set up on paper, with a view to getting down to the villages, the question arises as to the place of agricultural missions in these countries. In India, a Government rural credit system goes alongside of this research and education.

As one steps back to look at these movements as a whole, one asks again regarding the motives, and one realizes that much of this activity is focused upon the commercial agriculture—the agriculture that gives a basis for international trade—rather than upon the improvement of the life of the people in the villages. Nevertheless, it has in it that which when drawn upon properly, might be of significance in improving the quality of the life of the rural people. One of the things which impressed me in India was the spirit that was found among the students in the mission schools. The students were giving thought to the kind of lives they were hoping to live and the motives that were to determine their actions. The spirit I found at the Government agricultural colleges in the provinces of India was quite different. The motives there were primarily economic. In general, the students were selected at the Government agricultural colleges

with a view to training them for the civil service; for example, the agricultural extension service. I found also that the extension service was not reaching down adequately to the villages or making the impression on the villages that it should, even from this technical agricultural side. I doubt if we need an increase in highly trained technical specialists in the agricultural missions of either India or Japan, because of the high degree of technical skill brought to bear in research and education on the part of these Government agencies. One of the things that impressed me was the spiritual quality of the Englishmen, or rather Scotchmen, who were out there in charge of the Government agricultural activities; but more and more they are disappearing and the Hindus are occupying the principal positions in these schools.

While in South India visiting Hatch's rural reconstruction unit, I came to see that a very important relation might exist all over India between mission—led rural reconstruction units and the Government services that are available, but not adequately used. We visited the centre at Trivandrum, and also many of the village centres. I want to tell you what we saw going on in one of the village centres. In the first place, no road led into the village centre; there was a path, and over this path things were carried in and out of the centre. As we went along the path, we heard drums, and soon we saw a group of boy scouts, nicely plumed and costumed, coming to meet us. They have a troop of scouts there who do many of the things our boy scouts do in America, and get as big a thrill out of it. They took us back into the agricultural experiment grounds of this village. They had an agricultural organization there. The chairman was a Brahman. All castes were represented in this organization. The way in which the Government service was drawn upon by the local village group which had been organized by Hatch, was a fine example of the effectiveness of local leadership. Twenty-five farmers were participating in the experimental work. Each one had a part in the experiment. Each one was growing certain crops that he was not used to growing, and the county agent came to advise the farmers about how to conduct their experiments,

Through organization, this village had prepared a place where this government agent could find a close contact with the farmers and render a valuable service. When I left India, I had the feeling that much could be accomplished by providing the organization with right motives and spiritual leadership in these villages, that would give the people ambition and desire for improvement of their agriculture and the quality of their life, and by calling in the government agencies that have been set up for the improvement of agriculture and health. A good general knowledge of agricultural science is required for this leadership, but highly trained experts are not required.

In Japan, the farmers are themselves already organized from the bottom up. I think, from the things I have heard this morning, that there has been a great deal of progress in India since 1932. While Japan was well organized for disseminating agricultural information, the thing that was lacking was the spiritual elements in the motivations and in the entire structure of the civilization of rural Japan.

In China, conditions were different. There has been real reason for mission agricultural colleges which set examples of scientific work both from the standpoint of physical and biological science, rural economics, and rural sociology. There has been an important work for the agricultural colleges of both Nanking and Lingnan. It may be that when the government carries forward to the point where it will develop the institutions it now has had on paper for some time, there may be less need for this than formerly, but at the present time, certainly, it is these Christian interests that are taking the lead in setting the example and developing the pattern that will ultimately become important in the life of China, both from the standpoint of developing the sciences and the carrying of the findings into the villages.

It is significant that the motives of governments in aiding agriculture are, in the main, economic, political, or military. There is a tremendous function to be performed on the part of Christian interests in all countries to see that into this is brought also a Christian motivation in the building of a higher type of rural civilization.

THE PRINCIPLES OF MAKING JELLY.

By A. D. Chand, M. A., B. Sc. Ag., F. R. H. S.

Jelly making is both a science and an art. It is a science because it involves the use of abstract principles arrived at by (1) a definite pursuit of research in finding out the composition of fruits from which jelly can be made and (2) experiments to determine the exact proportion of ingredients required. It is an art because it requires a sound skill guided by definite rules. In order to manufacture jelly successfully it is necessary to understand its science and acquire its art. The art or skill alone may enable a person to manufacture jellies successfully, but it would only be possible if one follows a set of definite rules formulated by personal experiences after a great deal of laborious experimentation. But this trial and error method would be a long route, which would certainly require unfailing patience and a good deal of financial loss in the beginning. On the other hand if one knows the science, he can put those well-known principles into practice and attain perfection in considerably less time and at a very low cost. For the benefit of those who are interested in making jelly or its allied products, either for home use or for commercial purposes, both the science and the art of manufacturing these products will be concisely discussed in this chapter.

Before entering into a detailed discussion of the principles involved in making jelly, it seems altogether necessary to define jelly, so that those who still possess a loose conception of jelly may correct their faults at the very outset, by applying the underlying principles to the best of their knowledge.

Definition.—Fruit jelly is a product obtained by boiling fruits with or without water; extracting and straining the juice ; adding sugar and cooking it to such a consistency that a soft spring solid may be formed on cooling. A perfect jelly is clear, sparkling, translucent, of appealing flavour, attractive colour, and free from sediment. When poured out

from the container it should retain its form, quivering but not flowing. It should neither be syrupy, gummy, nor sticky. It should possess the aroma of the original fruit. It should be firm and should cut with a sharp, sparkling edge; and should retain its firmness even after cutting.

In order to produce fruit jelly successfully there are three essential ingredients,—pectin, acid, and sugar,—in addition to water. These three ingredients should be present in the right proportion in any juice which is used for making jelly. Fruits vary greatly in their suitability for jelly-making or in their acid or pectin content. The question of the sugar content of fruits is insignificant, because there is not a single fruit juice which can be used for making jelly without the addition of sugar. Acid and pectin are two essential substances which make fruits suitable for jelly.

Table I

Composition of fruits (After Macara)

Fruits.	Total sugar per cent as invert sugar.	Acid as citric crystal per cent.	Pectin per-cent as crude calciumpectate.
Gooseberries ..	3.51	2.22	0.81
Strawberries ..	5.48	0.93	0.53
Raspberries ..	3.58	1.73	0.53
Blackberries ..	5.10	0.85	0.59
Black Currant ..	6.43	3.48	1.08
Red Currant ..	4.80	2.54	0.58
Cherries (Stem Free) ..	8.43	0.88	0.24
Plums (Stone Free) ..	7.43	1.64	0.81
Golden Plums (Stone Free) ..	5.69	1.47	0.80
Red Plums (Stone Free)	7.56	1.74	0.82
Apples (Stone Free) ..	7.60	1.11	0.75

The proportion in which these constituents occur, varies greatly in different fruits; in different varieties of the same fruits; in the same variety at the different stages of ripeness; at different periods and conditions of storage of both fruits and juices, under different climatic conditions and on different

types of soils. The hereditary and environmental conditions are bound to influence the composition of fruits, therefore the above table should not be strictly depended upon. The manufacturer should always make the tests for acid and pectin, at least of all the fruit juices before making jellies.

The importance of acid in fruits for jelly making.— Except Van Fellenberg and a few others, who did not recognize the necessity of acid in the formation of jelly, all the other investigators unanimously concluded that the presence of acid was necessary for jelly formation. Cruess attached some importance to total acidity in the formation of jelly, saying that the acidity of the juice should be such that the finished jelly will contain at least 0.5 per cent. total acidity, but preferably 0.75 to 1.0 per cent. Lal Singh proved by his experiments that it was not the total acidity, but certain definite relation between acid, pectin and sugar that brings about the formation of jelly.

Ogg and Tarr were the first who proved by their experiment that the strength and the nature of jelly formation did not depend upon total acidity, but on the hydrogen concentration of the fruit juices which were used for making jelly.

So the presence of acid in fruit juices is highly important for making good jellies, because it gives firmness to the jelly in that it distends the pectin fibres, allowing them to attract sugar syrup in the interspaces. If the acid content is too little, the fibrillar structure of pectin fails to support the sugar and it results in poor jelly. On the other hand when the acid content is fairly high, the elasticity of the pectin fibrils is almost destroyed and a tough jelly results. It should not be inferred that the fruits of low acid content cannot be used for making jelly. The low acid fruits would indeed make good jellies if they were enriched with commercial acids. The acid used for jelly-making are tartaric, malic, and citric acids.

Tartaric acid is more efficient than malic, and the least efficient is citric acid. Tartaric acid is found in the greatest proportion in grapes; citric acid predominates in citrus fruits, cherries, currants, pears, raspberries and strawberries, while

malic acid is more highly concentrated in peaches, plums and quinces.

It is also customary, however, to blend the fruits of high acid content with those of low, for making jellies, but such products do not possess the distinct flavour of any of the fruits used. In order to overcome this difficulty, commercial acids may be used. The writer has used a concentrated solution of citric acid, having 0.577 grams per c. c. of solution, with remarkable results. The method of its preparation is given below :—

Preparation of acid solution :—Weigh 577 grammes of citric or tartaric acid crystals into a thoroughly cleansed 800 c. c. beaker and add about 200 c. c. of distilled water. Dissolved the crystals by warming the beaker gently over a slow flame, strirring it occasionally with a glass rod. When all the crystals are dissolved, cool the solution and filter it through clean cotton into a 1000 c. c. graduated cylinder. Rinse the beaker with distilled water and strain it into a cylinder with the solution. Then fill the cylinder to the 1000 mark by adding distilled water little by little, stirring it carefully. This solution containing 577 grammes in a little of distilled water gives approximately 0.577 grammes per c. c. of solution, because acid crystals also contain water of crystallization.

In order to find the strength of the solution accurately, dilute 1 c. c. of the above solution to 500 c. c. with distilled water and titrate an aliquot part with N/10 sodium hydroxide solution, using a drop of phenolphthalein solution as an indicator.

An acid test of fruit juices :—A simple acidity test of fruit juices for home use can be made as follows :—

Squeeze out juice from a few ripe limes, take an ounce of it to a tumbler, dilute it to eight ounces with water, add to it a tea-spoonful of sugar, stir it and compare its acidity by taste, with the acidity of the fruit juice. If the fruit juice does not taste even as much acid as this diluted lime juice, the juice is not suitable for jelly making unless it is enriched with artificial acid.

Determination of the amount of artificial acid to be used :—If the solutions of artificial acids are made according to the method described above, they will be very concentrated solutions and it will be necessary to find out how much of these solutions should be used with each pound of fruit juice for making good jelly. The amount of such solutions will vary with (a) the strength of the artificial acid solutions, (b) the activity of the different acid, and (c) the acid and pectin concentration of the jelly stock.

In order to find out the adequate amount of acid solutions to be added to each pound of juice, each acid of a constant strength shall have to be tried with various fruit juices used for making jelly. The suitable amount of the acid solutions is determined, with each fruit juice by a series of trials.

Start with 2 or 3 c. c. of acid solution per pound of juice, increasing 1 c. c. with every lot to 10 c. c. Determine the suitable amount from the texture of the jellies. Record the amount and strength of the acid on the labels of the bottles.

Pectin :—It is commonly known that the fruit juices owe their property of forming jelly when cooked with sugar to a substance called pectin. Braconnot was the first to define it in 1825 as "le principe gelatineuxdes fruit". Cruess defines it saying. "In defining pectin we refer to those bodies in fruits which go into colloidal solution in water and are derived from pectose (protopectose) by the ripening process or other forms of hydrolyses. Under certain conditions, in the presence of the proper proportions of sugar and acid they will form jelly."

The pectic substance primarily exists as pectose, protopsotin or pectocellulose in the middle lamellae of the cell-walls of fruits and other parts of plants such as leaves, roots, tubers, bark and stalk of fruits, but not in woody or corky tissues. In the above stage the pectic substance being insoluble does not possess jelling properties.

The Conversion of Pectose to Pectin :—Pectose is particularly abundant in fruits and fleshy roots during their hard

green stage. As the fruits ripen the pectose is gradually converted into pectin by the action of hydrolysing enzymes. This may also be accomplished by cooking the hard green fruits. When the fruits are overripe or cooked too long, the pectin is converted into pectic acid and methyl alcohol. Pectic acid, being partially insoluble, loses its jelling properties. These facts bring home to the manufacturers, the reasons why it is necessary to use only firm and slightly underripe fruits. It also makes clear that the period of cooking fruits and final boiling of fruit juices to jellies should be as short as possible.

Physical Properties of Pectin :—Pectin is a reversible colloid. It can be dissolved in water, reprecipitated and redissolved without any damage to its physical properties. It is due to this nature that aqua and dry pectin can be manufactured.

Method of Preparing Aqua Pectin :—It has already been mentioned that pectose from which pectin is derived exists abundantly in lemons, limes, currants, gooseberries, roselles, carrots, sugar beets, and apples, in their hard and slightly under matured stage. These can be used for extracting pectin for home use. The chief sources for extracting pectin on a commercial basis are the albede or white part of the rinds of citrus fruits, and pomace, culls, peels, and cores of sour apples. Such substances which are rich in pectin, are soaked in cold water in wooden vats for 12 to 24 hours. Most of the acid, sugar and other soluble matter is dissolved in the water, leaving behind pectin in the pulp. The water is drained off. The washed pulp is then covered with water containing 0. 2 per cent citric or tartaric acid and cooked rapidly in a covered pan for about twenty minutes. The juice is strained and the second extraction is made by adding half the volume of fresh water to the same pulp. When this mixture has boiled for about ten minutes, it is strained and filtered. Then both extractions are mixed together in a shallow pan and boiled rapidly until the juice is concentrated to a thick syrup. This syrup is poured boiling hot into sterilized bottles, and sealed at once, if the pectin is to be stored for later use.

Preparation of Powder Pectin :—Aqua pectin is good for household use, but for commercial purposes the manufacturing of dry or powder pectin is very important. The juices, from the fruits rich in pectin, are extracted as described above, but the pectin is precipitated from the concentrated juice by the following means :—

(1) by volatile substances such as alcohol and acetones.

(2) by aluminium hydroxide.

(3) by saturated commercial alum solution.

(4) by evaporation.

Precipitation :—Various methods of preparing powder pectin have been worked out by several authors such as Bourquelot, Herissy, Ogg, Carré and Haynes, but they all involve expensive apparatus. In all these methods pectin is precipitated by 95 per cent of denatured ethyl alcohol, but the chief objection levelled against these methods is that all the alcohol cannot be removed from the product. The method given by Cruess is a simple one. The fruits rich in pectin are boiled with several changes of water. The combined extracts are treated with a small quantily of commercial alum solution with constant stirring. Aluminium hydroxide is then added in slight excess of neutrality and the solution is warmed to coagulate a voluminous precipitate which forms on the addition of alum and ammonia. The liquid is then filtered and magnesium sulphate, in crystalline form is added at the boiling point, the addition and boiling continued until a precipitate no longer forms. The precipitate of pectin is separated by filtration and is washed with cold water to remove occluded salts. The washed pectin can then be dried and will retain its jelling properties indefinitely. T. N. Morris suggests acetone as the best precipitant, but the objection against it is that rectified acetone is expensive and his method requires special apparatus.

Suitability of fruits for making jelly.—All fruits are not suitable for making jelly. They vary a great deal. Some are rich in both acid and pectin, and they are the most suitable for making jelly; others are rich in one and poor in the

other, but some fruits lack both acid and pectin. The fruits poor in acid can be used for making jelly when lime juice or some other acid is added. To the fruits which are poor in pectin or lack pectin, home made or commercial pectin may be added for making jelly. The following table shows the classification of fruits according to their acid and pectin content.

Table II

Fruits rich in acid and pectin.	Fruits medium in acid and pectin.	Fruits rich in pectin and low in acid.	Fruits rich in acid and low in pectin.	Fruits poor in both acid and pectin.
Apple sour	Apples ripe	Banana ripe	Apricots	Apricots ripe
Blackberries sour	Blackberries	Carrots	Pineapples	Litchies
Currant red	Cherries	Cherries sweet	Tomatoes	Pomegranate
Currant black	Cape-Gooseberries	Figs ripe		Peaches ripe
Cherries sour	Grapes	Guava		Pears ripe
Crab apple	*Jamuns*	Peaches		Raspberries
Grapes sour	Loquats	Quinces ripe		Strawberries
Grapefruit	Quinces	Sugar beet		
Kumquat				
Karonda				
Kaitha				
Loganberries				
Lemons				
Orange sour				
Oranges sweet				
Plum sour				
Pummelo				
Roselle				

Pectin test.—The pectin concentration present in the fruit juices can be determined by the following methods :—

1. Take a table-spoonful of cooked fruit juice in a tumbler, add to it the same amount of 95 per cent rectified alcohol and stir the mixture gently. The mixture will form a thick gelatinous mass if the pectin content is high, a few coagulating lumps if the pectin content is medium, and only a few stringy precipitates, if it is poor in pectin. The alcohol has no effect if the juice contains no pectin.

2. A small amount of juice may be cooked with sugar to see whether it jells or not.

3. To two table-spoonfuls of fruit juice add a table-spoonful of magnesium sulphate, stir it and when the salt is dissolved, add a table-spoonful of sugar. Dissolve the sugar by stirring gently and let the mixture stand for half an hour. If the juice is rich in pectin, the mixture will form a thick mass; if medium in pectin, large flocculent particles; but if low or entirely lacking in pectin it will form no coagulation at all.

4. The pectin content is also measured by an instrument called a jelly meter.

5. The pectin in fruits is scientifically determined by the Carre and Haynes or Macara methods.

Sugar :—The sugar content of fruits is not as important as acid and pectin content, because no matter how much or how little the sugar content is, more must always be added to make jelly. But it must be remembered that the right amount of additional sugar required can only be determined on the basis of sugar already present in the fruits. Sugar is necessary for the coagulation of jelly, increases the volume of outturn and dilutes the pectin. The production of good jelly does not depend on the amount of acid, pectin and sugar in the fruit juices, but upon the relative proportion in which they are combined. The amount of sugar required is definitely related to the acid, pectin and salt present in the juices.

Relation of Sugar to Pectin :—The part played by sugar in the formation of jelly is usually lost sight of. As a result of the work of several pioneers great emphasis is now laid on the definite relation of sugar and pectin. It has been found that an increase in the concentration of pectin requires a relative increase in sugar for jell formation to occur. With a low pectin concentration jell formation does not occur until the sugar concentration has reached 60 per cent in the final product. With a medium amount of pectin, sugar concentration reaches 67 to 68 per cent, but with juices rich in pectin, sugar concentration rises as high as 70 to 72 per cent.

The reason why people fail to get good jelly from juices rich in acid and pectin is that they do not know the relative

amount of sugar required. If the juices are deficient in pectin and too much sugar is employed the resultant jelly will either fail to set or will remain syrupy and sticky. Sugar crystals also form in it. On the other hand if the juices are rich in pectin and too little sugar is added, the texture of the jelly will become very tough and leathery. It is therefore necessary to lay down certain definite principles for adding sugar to juices varying in pectin content, provided the acid content is adequate. The amount of sugar may vary from half a pound per one pound of juice low in pectin to one and a half pound if the juice is rich in pectin.

The fruit juices of 0.75 per cent pectin concentration can safely be used for making jelly, but the best jellies can only be made when the pectin concentration ranges between 0.85 to 1.20 per cent.

Relation of sugar to acid.—What is said about the relation of sugar to pectin holds good in this case also, but not with the same rigidity. The results of Ogg's and Tarr's experiments indicate that the galling strength does not depend upon the total acidity, but on the hydrogan content which depends upon the presence of particular acid and on the buffer action of salts, which are also present in the fruit juices. All the acids which are employed in jelly making are not equally active. Tartaric acid is the most active, malic next, and the citric least. So as a general rule the greater the active acidity of the juice, the more is the sugar requirement and the greater is the yield of jelly. Lal Singh brings out the same fact in the following experiment. With juice of 0.12 per cent. citric acid 75 grammes of sugar was necessary to form 100 grammes of jelly, while at 1.05 per cent acidity the same amount of jelly was produced using only 55½ grammes of sugar. By increasing the acidity to the adequate amount he shows a saving of 30 per cent sugar. As sugar is the most expensive element in jelly making, it is therefore advisable to raise the acidity of juices which are deficient in acid to at least 1.05 per cent.

Relation of hydrogen ions to acid and pectin.—Two contemporaries, Ogg in Britain and Tarr in America, established independently that the formation of jelly depends

upon the hydrogen ion concentration and not on the total acidity.

The presence of salts in the fruit juices reduce the hydrogen ion concentration, without thereby changing the total acidity. They both therefore, strongly assert that the manufacturers should not go by the total acidity. It is the p^H value which is more reliable. The minimum concentration at which jelly formation occurs is p^H 3.46 independent of the kind of acid used. A good jelly is formed at p^H 3·3. If jelly is made for export, p^H 3.2 is necessary to make a fairly stiff jelly. As a general rule, jelly becomes stiffer with the rise of hydrogen ion concentration and softer with the fall of hydrogen ion concentration, but the limit should be between p^H 3.46 and p^H 3.1.

Table III

Name of fruits.	p^H of raw Juice.	Name of fruits.	p^H of Juice.
Apples	3.35	Plums ..	3.60
Apricots	3.84	Quinces ..	3.20
Blackberries ..	3.50	Raspberries Red ..	3.30
Cherries	3.90	Raspberries Black ..	3 60
Currants red ..	3.60	Strawberries ..	3.70
Grapes ..	3.80	Tomatoes ..	5.05
Grapefruit ..	3.40		
Currant black ..	3.40		
Lemons ..	2.55		
Loganberries ..	3.30		
Oranges ..	2.40		
Prunes ..	4.20		
Peaches ..	4.80		
Pears	4.20		

The determination of hydrogen ion concentration is of great importance, but it involves the handling of special apparatus. For ordinary purposes a simple acid test would be all that is required.

The role of salts in making jelly.—It has been generally conceded that the formation of jelly depends, to a great extent, upon the acid and pectin contents of the fruit juices. Tarr's research brought home the fact that the formation of jelly does not depend upon the total acidity,

but on the definite range of hydrogen ion concentration provided the pectin content of the juice is just enough to support jelly formation. A few years later Mayers and Baker, basing their further research on Tarr's findings, made studies on the role of salts in the formation of jelly. They found out that though hydrogen ion concentration is the deciding factor in the formation of jelly, yet the presence of various salts in the fruit juices disturbs the hydrogen ion concentration and thus effects the jelly strength of the juice.

The effect of salts on hydrogen concentration.—Fruits naturally contain many substances, such as salts of acids, starch, gums, tannates, pectin and protein, which exert buffer action, but the most important of these substances are the salts of the fruit acids, which may be present in a free or combined state. The buffer action of various salts is not uniform on the various fruit acids, but it varies with the nature and concentration of the ions of the salts and acid in the solution. Salts tend to exert a buffer action on acid solutions and consequently at a definite hydrogen ion concentration the total acidity will vary, to a certain extent with the salt concentration.

Some salts have strong basic while others have strong acid ions. It was due to the acid reaction of salts that Van Fellenberg stated that he was able to form jelly by the addition of certain salt to pectin solution which did not contain acid. He did not take the hydrogen ion concentration of the solution, so the probabilities are that either he added acid salts or the base of the salts was absorbed by the pectin, leaving the juice high enough in hydrogen ion concentration. The fact remains intact that jelly formation does depend upon the hydrogen ion concentration, whether it be due to the acid or acid salts.

The total acidity varies, depending upon the activity of the acids in the fruit juices which brings about the optimum or minimum points of hydrogen ion concentration at which the jelly forms. If the juices contain the optimum hydrogen ion concentration the increase of acid salts such as sodium sulphate would further increase the p^H value and the jelly

strength would be decreased and consequently syneresis would result.

On the other hand if the salts of a strong base such as sodium hydrogen citrate are present in sufficient quantity in the juice the p^H value of which has already exceeded the optimum jelly strength, the salts function as buffering and peptizing agents, thereby increasing the jelly strength and preventing syneresis. If the ionic concentration is already too high an increase in anion concentration would not prevent syneresis. If the hydrogen ion concentration is low the cations of the salt act similarly to the hydrogen ions of the acid, and the jelly strength is brought to an optimum point. A further increase in cation concentration causes a decrease in jelly strength. It is therefore evident that syneresis is either caused by the hydrogen ion alone, or by the hydrogen ion in conjunction with cation of salts; but not by the cation alone.

Effect of salts on sugar.—The quantity of sugar that may be added depends upon the hydrogen ion concentration of the juice. Within certain limits the greater the hydrogen ion concentration the more the sugar, which may be added. As the p^H value is effected by salts, it is evident that the amount of sugar required may be affected by organic and inorganic substances present in the fruit juices. The salt increases the solubility of sugar and it is believed that the concentration of sugar that exists in the jelly approximates that of an ordinary saturated solution of sugar in fruit juices. Tarr also observed that the sugar concentration increases with the increase of salt in the fruit juice, to a certain limit.

Effect of salts on pectin :—It is stated by Myers and Baker that clear sparkling jellies were obtained from a pectin solution containing appreciable quantities of salts, while cloudy and dull appearing jellies otherwise resulted. They also found out that the jelly strength is increased with an increase in the viscosity of the pectin solution. Certain substances, even after removing starch and protein from the fruit juice, give high and other low viscosity. It is the former which are of great importance in producing a greater

jelly strength, regardless of the concentration of pectin. The viscosity is decreased rapidly by prolonged boiling and also decreased slightly as the hydrogen concentration of the pectin solution is increased. It is therefore necessary to guard against these two factors in order to obtain high viscosity in the fruit juices.

Defects in jellies, their causes and remedies

Syrupy Jelly:—The most common cause of syrupy jelly is the presence of too much sugar in relation to the pectin concentration of the juice or insufficiency of acidity. If the juice is low in pectin content the unsweetened fruit juice may be reboiled until it gives a reliable pectin test or less sugar may be added so that the deficiency may be made up by the evaporation of the excess water. Home made or commercial pectin may be added to correct the pectin content. If the acidity is less or is lacking, it may be made good either by adding sour lemon juice or a saturated solution of citric or tartaric acid.

Tough Jelly.—Tough jelly results when either too little sugar, or too highly concentrated fruit juices are used. If the rules for adding sugar are kept in mind one may be sure of getting good jelly.

In order to avoid too much concentration of fruit juices, sufficient water should be used at the time of extracting the juices. The quantity of water necessary for extracting juices from different fruits is given in the next chapter.

Gummy or Sticky Jelly.—Prolonged boiling of fruits or juices causes gumminess or stickiness in jelly. Probably it is due to the hydrolysis of pectin and sugar. Prolonged boiling not only causes gumminess but also darkens the jelly.

Crystal formation in Jelly.—Sugar crystals are formed in the jelly when too much sugar, in relation to acid content of the juices, is used. The amount of sugar may carefully be determined to avoid crystallization. Crystals of cream of tartar or potassium acid tartar sometime occur in grape jelly. In order to avoid crystal formation in grape jelly either the grape juice should be mixed with other fruits

or it should be allowed to stand in shallow pans for twenty-four hours. The crystals will settle down to the bottom and the juice may be siphoned off and used for jelly.

Weeping Jelly.—Weeping jelly or syneresis is caused by the high concentration of acid in the juice. It can be prevented by mixing the fruit juices low in acid or by adding more pectin and sugar

Cloudiness.—Jelly may turn out to be cloudy due to the following causes:—

(*a*) If the fruits are not properly washed, before extracting juice.

(*b*) If the juice is poorly strained.

(*c*) If the jelly is not properly skimmed during boiling before pouring into the jars.

(*d*) If the jelly stock contains appreciable quantities of salts, the jellies produced from them will be clear and sparkling, otherwise they will result into cloudy and dull appearance.

(*e*) If the jelly is allowed to stand until it is partially set, before pouring into the jars.

Dark Jelly.—Jelly as well as other fruit products usually have bright colour and an attractive appearance when freshly made, but on standing especially in hot stores, and intense bright light, gradually lose their firmness as well as bright appearance and finally become absolutely dark and unmarketable. The fruit products also become dark if their boiling period is prolonged. In order to retain the same firmness and brilliant colour of the fruit products, excessive boiling should be avoided and the containers should be wrapped and stored in cool places.

Causes of Spoilage of Fruit Products and their Prevention

Moulding of Jelly.—The moulding of jelly and other fruit products is caused by micro organisms such as moulds. The most common, and the most troublesome moulds to the manufacturers are those belonging to the genera *Penicillium* and *Aspergillus*. In the early stage of growth *Penicillium*

expansum is simply a network of white filaments (Mycelium), but in the later stage, at the appearance of the spores, the colour changes to green, blue, pink or brown. This mould imparts a very offensive odour and disagreeable taste to product. The spores of *Penicillium expansum* are spherical, borne in abundance on perpendicular hyphæ and much branched conidiophores.

Another common mould is *Aspergillus niger* or black mould. The hyphæ of this mould are white, resembling *Penicillium expansum* and bear an abundance of black spores. It dehydrolysis sugar into oxalic acid and thus imparts a sour taste to the fruit products. Mucor or bread mould, usually attacks starch and is not important as a cause of spoilage. There are a few species of it which convert sugar into alcohol and carbon dioxide. Only a few moulds possess this characteristic.

Fermentation of Jelly.—Fermentation of jelly is caused by yeasts and bacteria. The yeasts are useful as well as harmful. They are useful in the manufacturing of several fruit products as well as alcohol and vinegar, because yeasts have the property of breaking starch into sugar and then to alcohol. They are harmful because they destroy not only sugar but alcohol and the acids of the fruit juices and fruit products by oxidizing them into carbon dioxide and water.

Bacteria like yeasts are also useful as well as harmful. The vinegar bacteria help in the formation of vinegar, when the alcoholic fermentation is set up by yeasts. There are other species of bacteria such as lactic acid bacteria and a few others which render the products unwholesome. It is *Bacillus botulinus*, a species of bacteria, which is the most dangerous as regards the fruit industry. It is spore forming and highly heat-resistant, and developes in carelessly sterilized canned fruits, producing a very virulent poison. Therefore, the manufacturer should be very careful in sealing the fruit products.

The most common causes of spoilage are:—

(1) Insufficiency of sugar concentration in the finished product which affords a suitable medium for micro-organsim development.

(2) Insufficiently hot paraffin used for sealing which does not sterilize the exposed surface of the jelly.
(3) Incomplete seal of paraffin or a paraffin layer which has become loose.
(4) Incomplete sterilization.
(5) Storing in a damp place.

If the fruit products are made under sanitary conditions and the following simple rules are employed to destroy and to avoid the organism, fruit products can be kept from spoilage indefinitely.

(1) Sterilize all the containers before using.
(2) Use unblemished fruits.
(3) Increase the sugar concentration to a point in which micro organisms cannot live or develope.
(4) Pour boiling hot fruit products in hot sterilized containers.
(5) Avoid contamination before sealing.
(6) Seal perfectly or hermetically.
(7) Replace the paraffin seal if it becomes loose.
(8) Sterilize canned fruit products properly.
(9) Store in a cool dry place.

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A PLEA FOR BUFFALO BREEDING AND IMPROVEMENT OF CATTLE IN ASSAM

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The welfare of a country and its people depends to a large extent on the healthy population of its cattle. The term cattle includes cows, bullocks, buffaloes, horses, sheep, goats, etc. In Western countries special animals have been reared for special purposes, but in India attention has mostly been paid to the breeding of cows and bullocks. In the West, the buffalo has not been reared for special purposes, but in the East this animal was included in the list of domestic cattle used for the supply of milk and also for the purpose of ploughing and carting. It is strange but true that in Northern India specially in the Punjab, this animal has been bred into such a fine state as to give 15 to 20 seers of milk per day. But in Assam, the natural habitat of this animal, the milk resources from it are practically nil. The average yield of milk is two seers per day.

So far the potentialities of buffalo power have not been explored in Assam. Research work has been directed mainly towards the breeding of good bullocks and cows for the farmer. There is a case for the buffalo too. The writer has seen cross-bred buffalo calves, the cross taking place between the wild buffalo bull and the domestic female in *Khutis* (herds) grazing near Goalpara and Kamrup reserved forests where wild buffaloes are met with. It is an interesting sight to see a cross-bred calf running shy from human beings in its early life. The buffalo is reared for milk and draught purposes by the Nepalis, Barpetias, Santals and Manipuris of the Brahmaputra and Surma Valleys of Assam. The climate of Assam is also ideal for the buffalo. How it enjoys a mud-bath is a fine sight to see ! Ploughing for paddy goes on in soaked ground and pouring rain and the best animal

for such an operation is the buffalo who, there is no doubt, is not in any way worse off after a day's work. A wet bullock after a similar operation is a sad sight to see with its ears and face pulled down and coat soaked and bled in places by leeches which are very numerous in the Assam Valley. For carrying heavy loads during the night and the cool hours of the morning, the buffalo is far superior to any bullock used for draught. Buffalo power plays an important role in timber extraction in the Assam Dooars.

The climate of Assam is very damp. The rain-fall, 100″—140″ on the average, annually adversely affects the health of cattle. Hundreds of bullocks are annually imported into Assam from Bihar, but their health deteriorates and the average life is cut short by the dampness and insects which are so abundant in Assam. Watch a herd being driven to and from the village in the rainy season! The legs are smeared with mud, the skin is wet for want of a proper shelter against rain and is covered with wounds and bleedings made by insects and leeches in the cattle compound. What a painful sight again!

Most of the hill tribes forming the bulk of the population of Assam dislike milk. Some tribes like the Garos, Rabhas, Cacharis can hardly stand the smell of milk even. So it is quite natural that such people would not take much interest in the welfare of its cattle. Probably it will not be far from the truth to say that the cultivators of the province are ignorant of the elementay principles of cattle management, nor do they yet appreciate the value of scientific treatment when epidemics break up. Waste lands are being utilized as grazing grounds. But grasses of poor quality predominate in most of the lands. Doob grass (*Cynodon dactylon*) is generally absent. Such lands are specially poor in good quality grasses because waste lands are not sufficiently utilized for temporary cultivation which encourages growth of tender, nourishing grasses common round about new settlements. Grazing grounds are on the decrease as waste lands are being rapidly settled with new immigrants who are daily invading Assam. Village herds are far too many, and in consequence for want of sufficient fodder, the health of cattle suffers.

In an Assam village cattle are allowed to go astray in the morning for grazing without a cow-herd with the result that one finds one or two always missing at the end of the day, being either devoured by wild beasts or meeting accidental death. Stall feeding is not practised. In the day time walking all day they have to search for bits of grass in impoverished grazing grounds or muddy and flooded fields, and in doing so exhaust all their energy. On returning home they have to stand in a muddy shed or compound with dry paddy straw for them to eat. It is no wonder that cattle are shortlived, weak and poor in milk supply.

In Northern India it is a common sight to see a piece of rock salt kept for the cattle to lick according to their need. In Assam, cattle are scarcely even given any salt, although this is one of the essential requirements in animal feeding.

The time has therefore come that we should import some buffaloes both male and female from Delhi and the Punjab and start experiments on our farms in Assam. Improvement of the buffalo is a much easier problem than evolving a strain of a bullock to withstand the rigours of the wet climate of Assam. Grazing grounds should be constituted, and improvements undertaken. The apathy of the masses should be removed by vigorous propaganda through the press, departmental leaflets, demonstrations, exhibitions and *melas* (fairs).

A REVIEW

THE GARDENER, now in its second volume, seems to have found a useful place in Indian horticultural literature This is a spritely illustrated journal published by the well-known firm of seed merchants, Pestonjee P. Pocha and Sons, of Poona. While the articles are written in a popular style, to appeal to the amateur gardener, care is apparently taken to see that they are accurate. The experience of successful gardeners in this country is emphasized. Flowers and ornamental gardening, vegetables, and fruits are all given attention. We wish this useful publication continued success.

"OUR III YEAR TRIP IN 1938"

By N. B. Syamal.

(Student 1st Yr. B.Sc. Ag.)

"Hurrah", the day has come at last, when we shall be relieved of tedious class room work for at least 2 weeks, not only to have a happy trip but also to widen our outlook regarding the agricultural and industrial situation of India; adding more and more to the knowledge gained in our 1st year trip.

We left Allahabad on the evening of January 2nd for Indore, accompanied by Dr. Vestal and Mr. Vachoo. At Indore our programme was first to visit the Institute of Plant Industry, which is in fact a leading institution in India in the work of plant breeding. There we were first of all shown by Mr. R. L. M. Ghose, the recent classification of cotton worked out by Mr. Hutchinson, which was based on the chromosome content of cotton. Then we were shown the different varieties of cotton which they have obtained either by selection or hybridization. Malvi 9-20 has been found to be the best for that area. Then we were taken round the fields and shown the various experiments which were being conducted with cotton and *juar* regarding yield and disease resistance. Among the implements which we were shown only the *bakhar* and *dora* which are most extensively used there, need to be mentioned. The *bakhar* serves the purpose of a plough in Indore. It simply stirs the soil to a depth of about 3—4 inches. The *dora* or miniature *bakhar* was used for interculture and is similar to a *bakhar* though smaller in size. There are other *desi* ploughs also which are not so extensively used there as the *bakhar*.

Then we were shown the so-called Indore method of composting which is as follows. A trench is dug $2\frac{1}{2}$—3′ deep, 10 ft. wide, and 30-40′ long, and all sorts of waste materials are put into it. These things are turned over 3 times in the

year and watered 6 times. The manure is ready in 3 months and 4 consignments can be had in a year.

In the chemical section of the institute we were shown the work that was being done in connection with the analysis of the various types of soil, and compost obtained by the decomposition of different waste materials.

In the afternoon of the same day we went to see Sir Hukum Chand's cotton mill. It was indeed a large mill employing about 8,000 labourers including men, women and children. The men working in some of the departments of the mill are very short-lived, due to the high humidity and temperature of the rooms in which they work. Also the rumbling noise of the weaving machines would surely make the men deaf after a few years. Here, we were able to see all the processes, too long and complicated to relate here, which the raw cotton has to undergo before it comes out as ***saries, dhoties*** and cloths of various kinds.

Next morning we left for Broach which we reached after a change at Ratlam. At Broach we went to see the Government Experimental Farm. The main crop that was grown here was cotton. The main varieties grown here are:

(1) Goghari or G.A.26.—This variety has a spinning value of 12 counts, a staple length of 0.7" and ginning percentage of 47. This variety is 39% susceptible to wilt.

(2) B.D.8 (Broach Desi).—This variety has a staple length of 0.9', a spinning capacity of 40 counts, but it has a low ginning percentage of 33. It is cent percent resistant to wilt and is doing best in that area.

(3) Broach local.—It has a staple length of 0.8', a spinning capacity of 16 counts and a ginning percentage of 40. This variety is about 41 per cent. susceptible to wilt.

There was nothing else of much interests at Broach so we left for Kosamba.

At Kosamba we were scheduled to see the rural reconstruction centre which was under the management of a gentleman named Mr. J. Vanikar. As this gentleman was out of

town, then another man took us round to see a farm which belongs to a man named Vallalbhai Patel. This man had no capital to start this farm, so he borrowed some money from the Government and bought some land, and working under the directions of the rural reconstruction centre, after a few years he was able to repay all his loans, and at present makes a profit of about Rs.400 every month. The area under his farm will not exceed two acres, and vegetables are the main crops. When Mr. J. Vanikar came back, he took us round to see some of the villages, and it was a pleasure to see the low caste people, the so-called Harijans, live in houses though made of mud which were as clean as any of our houses. In each home the women folk, including the young girls, were taught how to spin thread with a small portable *charkha*, how to weave cloth and *newar* for camp cots and several other things which would bring some monetary return to the family; some families also kept a few fowls. On the whole it gave us the impression that even these low caste people could be taught to live as decently as any other caste or creed of people on the face of the earth; and their education and uplift should be the duty of every person who has the privilege to do so. We were then shown a small orchard close to the station, where grapes seemed to be the major crop, the vines trailed along bamboo poles posted close to the plants and tied to a cross-bar along which the plants also trailed.

That very day we left Kosamba for Surat. Here we went to see the Government Experimental Farm which was a few miles away from the station and we had to go by bus. At the Farm we were taken round the fields first, and we were given to understand that the best variety of cotton that they had there was 1027 A.L.F. It was obtained there by crossing two varieties known as Goghari and Kumti. The staple length of this cotton was 23.6 mm., ginning percentage 35 per cent, spinning capacity 32 counts. It gave a linit yield of 126 lbs per acre and the seed cotton yield was 360 lbs. The value that they got there per kandy (784 lbs) was Rs.425. Wilt disease is not common there, so that this variety does not suffer much from the attack of this disease. The next

crop that we were shown there was *juar*. Since it is the staple food of the people there, its cultivation is quite extensive. The best variety of *juar* growing there is known as Budh Perio 53. It gave an average yield of 1159 lbs. of grain per acre, while the local varieties gave about 1018 lbs. per acre. There were other experiments which were being conducted there, but the most noteworthy one is that regarding the manure for cotton plants. First of all farm yard manure was tried at the rate of 10 cart-loads of 400lbs. each, but this was not quite satisfactory as the ammonium sulphate which was applied at the rate of 40lbs. after the plants were one month old; this not only gave a higher yield of cotton that year, but also increased the yield of the next *juar* crop with which the cotton was rotated. Cotton sometimes requires green manuring and this is done by sowing *dhaincha* (*Sesbania aculeata*) in between the cotton plants which were sown 6 feet apart. When the *dhaincha* plants are about a month old they are ploughed under.

Here we also saw the dairy. They maintained the Kankrej breed of cattle and produced some very fine bullocks.

We left Surat for Bombay, the second largest city in India. The scenery that we saw on our way from Surat to Bombay was very beautiful. The high mountains on one side and the deep valleys on the other covered with green foliage all around were very soothing to the eyes. Then suddenly the train would pass through a dark tunnel cut through the mountain ranges and then sweep round another hill. Then every head was peeping out of the compartment to catch a glimpse of the promised town from a distance. Finally the train slid into the station—Bombay Central.

We occupied a decent hotel close by the station. Next day we went to see the Haffkine Institute. In this Institute research is carried on with the venoms of various kinds of snakes. The gentleman in charge of the laboratory showed us all the different kinds of snakes and also told us how to distinguish a poisonous from a non-poisonous snake, which is as follows:

(1) Scales on belly similar to those on back (Fig. I) or broad (ventrals), not extending completely across (Fig 2)—non-poisonous.

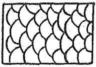
Fig. 1

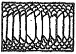
Fig. 2

(2) Scales on belly, broad (ventrals) extending completely across, fangs present. (Fig 3)—Poisonous.

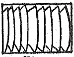
Fig. 3

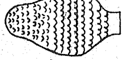
Fig. 4

(3) Scales on top of head are small, head pear shaped, sharply separated from rest of body (Fig. 4)—Poisonous.

(4) Some scales on top head are large (Fig. 5) May be poisonous.

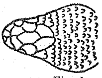
Fig. 5


Fig. 6

(5) Pit at side of head (Fig. 6)—Poisonous.

(6) Third supra-labial (not counting anterior central scale) touches nasal scale and eye (Fig. 7)—Poisonous.


Fig. 7

(7) Large scales on top of head, not pit, third supralabial does not touch nasal scale and eye (Fig. 8)—May be poisonous.

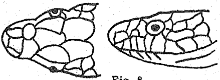

Fig. 8

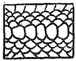

Fig. 9

(8) Central row of scales on back are definitely the largest (Fig. 9)—May be poisonous.

The python is not poisonous but it kills its prey by squeezing it to death. We saw a rat being squeezed to death inside the cage.

Then he showed us how the snake's venom is taken out. The servant there, an expert at catching snakes, caught one by the head and opened its mouth. The fangs were visible and also the venom sac. The gentleman then took a glass dish and held it below the fangs and pressed the venom sac, immediately the venom was poured out as a white slimy liquid resembling gruel. This venom cannot be kept in this liquid form for a very long time, so if it has to be stored it has to be done so in the dried form. Anti-venoms are also prepared for the bites of some of the very poisonous snakes like the cobra.

From here we proceed to the Veterinary College. Here the professor who showed us round the various departments explained the different things in such a hurry that it was practically impossible for any of us who knew very little of veterinary to grasp what he said and to remember it.

In Bombay there was nothing much to see by the way of agriculture, but there was much sight-seeing. Among the various things that we saw, only a few need be mentioned here. Bombay is such a place where a person need never feel tired, thirsty or hungry, provided he has sufficient money,

for throughout the length and breadth of Bombay are restaurants, bars and hotels. The Juhu beach with its Palm Beach Hotel is an ideal place for romance, though the Malabar Hills cannot be omitted in this respect. I will not take any more time and space in describing Bombay, though pages after pages can be written about it, and proceed to the next place to which we went, Poona.

At Poona the Ganeshkhind Gardens are the most interesting horticultural centre. Originally it was a botanical garden, but now it has been transformed into a fruit growing centre They have grapes, Italian lemons, bananas and many other fruits in great profusion. The chief work here may be considered to be the experiments carried out for preserving fruits in cold storage. We were taken round different chambers the temperature ranging from 32 F. to 68 F. The following table will show the result that they obtained with the different fruits and vegetables under different temperatures.

Temp. in storage.	
32 F	Apples keep well for more than 4 months.
35 F	*Desi* (local) potatoes keep well and do not sprout even after 10 months. Apples and oranges keep well for 4 months, but they shrink a little.
40 F	Hill potatoes keeps more than a year. *Desi* potatoes sprout at 9 months. Oranges kept for 3 months were perfectly normal. Pomegranates shrunk after 4 months.
45 F	Grapes keep well for 6 months. Mangoes and oranges also keep well.
52 F	Oranges obtain beautiful colour at this temp. and keep well the year round.
56 F	Bananas kept for 2 months showed 10% loss.

68 F At this temperature sprouting of potatoes is activated.

Turning from the Ganeshkhind Garden we went to the Observatory which is one of the largest observatories in India. Here we saw the various instruments used in forecasting weather which for me are too complicated to describe here. I will, however, mention one instrument. This instrument is fitted on to a thin bamboo frame and attached to a balloon. As the balloon ascends it automatically records the temperature, humidity and wind direction in the different layers of atmosphere, and finally when the balloon falls all these things are known.

The Poona Agricultural College Farm was the next thing that we saw. Of all the various departments in the college the Engineering department seemed to be the best. Here various kinds of water lifts were demonstrated which were worked by crude oil engines. In the college farm the crop museum attracted our attention most. Here a person could see at a glance both ***rabi*** and some ***kharif*** crops and several other perennial plants like the agave, yam and ***bhang*** (***Cannabis sativa***) which cannot be seen everywhere.

From Poona we proceeded to Nagpur where we stayed at the Agricultural College. The next day we went to see the college farm. Here we saw the same implements as those we saw at Indore and Poona. The main crops grown at Nagpur are cotton, ***berseem*** and peanuts. The college dairy maintains a peculiar breed of cattle. At first they had a Sindhi breed and in order to increase its milk yield they crossed it with an Ayrshire bull. Then again in order to get a dual purpose breed they crossed it with Hariana, and the resulting breed was peculiar. They had some Murra buffaloes also.

Among the other departments and college laboratories I will mention only a few. In the Botany section some experiments were being conducted in crossing wheat which had a chromosome content of 48 with a grass which had

chromosome content of 72 and they were successful in getting a few plants. The idea in doing this was to obtain a variety of wheat which would be very rust resistant.

In the Mycology section Dr. Dastur explained to us some of the diseases of citrus and a few other crops.

In the Entomologica' section, we were shown a certain insect which burrows into the bark of citrus trees and practically ruins an orchard if proper precautions are not taken. Chlorosol was recommended for killing these insects, by just applying it into the hole in which the insect lived.

The Horticultural Department was the most interesting. With the oranges hanging over our heads we were tempted to pluck off some to quench our thirst. These oranges we were told were growing on land which was under drained. Some experiments had been conducted there to show the effect of stock on scion in grafted citrus plants. These experiments showed that the stock had practically no influence on the size, shape, taste or texture of the fruits borne on the scion.

The Telankheri Dairy is worth mentioning here. It is situated on a hill with a lake in front and hills and jungles all around. This dairy is run on a co-op'rative basis. It has 18 members all of whom reside in the city, and together they have 631 cows. These cattle all belonged to the members. The milk is taken by the dairy from the members and sold to the town folks, the dairy keeping a small profit. The dairy take charge of feeding and maintaining the cattle. They have a few acres of land where they grow their own fodder. Out of the profits that they realise, they maintain a small school for boys and also pay the servants. They also have a poultry farm. They have several breeds of poultry, but the white leghorn is the best. They had imported a new breed of poultry from Holland which seems a very promising one in that area.

Our next and last station in our tour was Jubbulpore. The Government Military Dairy Farm here is worth mentioning, for it is the best equipped dairy that we saw on the

whole trip. The breed maintained is a cross between Holstein Friesian Bull and Sindhi cows. They had some Murra buffaloes also.

The Marble Rocks of Jubbulpore are noteworthy. Though we were unfortunate in not being able to see them by moonlight, even the twilight showed their beauty. The huge gorge with the blue and white marble rocks on either side, and the clear, fathomless water, flowing between them, proved another place of romance. Here as we were going up the stream in a boat we were told by the boatmen not to smoke, as there were bees in the rocks which were attracted by light and which might sting all of us to death.

After this tour, if I were to give my opinion regarding the agricultural situation in India, I would say, that a great deal of experimental work is being done throughout India. If the results of the experiments were given to the poor farmers, they could increase the yield of the main food crops and also would be profited immensely.

Again, I would say that there are several colleges for agriculture throughout India, with very well equipped laboratories and huge buildings, but the work done and the utilization of these laboratories is very discouraging. But the Allahabad Agricultural Institute, I am forced to say, with its limited equipments in the laboratories and dairy is the best utilized by the students and the results shown by it are the best that I have seen on the whole tour.

REPORT FROM THE DEPARTMENT OF AGRICULTURE, UNITED PROVINCES

FOR MAY, 1938

I—Season.—Light and scattered showers were received in the first and third weeks of May, 1938, but the rainfall in the second and fourth weeks was general throughout the provinces. It was above the normal in 18 districts, 11 districts mostly in Gorakhpur Division and Oudh recording from 1 to 5·10".

II—Agricultural Operations.—Agricultural operations are generally up-to-date. Irrigation of sugarcane and extra crops and preparation of land for *kharif* crops are in progress.

III—Standing Crops—and *IV—Prospects of the Harvest.*—The condition of standing crops is satisfactory and the prospects are favourable.

V—Damage to Crops.—There is nothing to report under this head.

VI—Condition of Agricultural Stock.—The condition of agricultural stock is reported to be on the whole satisfactory. Foot and mouth disease has declined to some extent, but rinderpest and haemorrhagic septicaemia have increased considerably as is indicated by the following figures furnished by the Director of Veterinary Services:

Disease	April, 1938		May, 1938	
	Seizures	Deaths	Seizures	Deaths
Rinderpest . .	3,625	1,685	7,803	4,118
Foot and mouth .. .	5,898	90	5,173	47
Haemorrhagic septicaemia .	91	84	146	134

VII—Pasturage and Fodder.—Fodder and water are reported to be sufficient everywhere.

VIII—Trade and Prices.—The prices of chief food grains except barley and gram have further fallen slightly. The following figures compare the average retail prices in rupees per maund in May with those of the preceding month:

			End of April, 1938	End of May, 1938
Wheat	..	..	2·831	2·716
Barley	..	..	1·977	1·894
Gram	..	..	2·214	2·294
Rice	..	..	3·012	3·891
Arhar dal	..	..	4·556	4·464

IX—Health and Labour in Rural Areas.—The condition of the labouring and agricultural classes is reported to be satisfactory. Plague, cholera and smallpox are still reported from a number of districts.

For June, 1938

I—Season.—There was above normal and heavy rainfall in all districts of the Provinces with the exception of some districts in Meerut Division. It was above 10 inches in 15 districts, Gonda topping the list with a record of 18·45 inches.

II—Agricultural Operations.—Agricultural operations are generally up-to-date except in Meerut where they are reported to be backward for want of sufficient rain. Preparation of land for, and sowing of *kharif* continues.

III—Standing Crops—and *IV—Prospects of the Harvest.*—Condition of standing crops is satisfactory and prospects are favourable.

V—Damage to Crops.—No damage to crops is reported.

VI—Agricultural Stock.—The condition of Agricultural stock is reported to be on the whole satisfactory. Rin-

derpest and foot and mouth disease have declined to some extent, but haemorrhagic septicaemia has increased as is indicated by the following figures furnished by the Director of Veterinary Services:

Disease	May, 1938		June, 1938	
	Seizures	Deaths	Seizures	Deaths
Rinderpest	7,803	4,118	5,711	3,066
Foot and mouth	5,173	47	2,673	36
Haemorrhagic septicaemia ..	146	134	620	545

VII—Pasturage and Fodder.—Fodder and water are sufficient everywhere.

VIII—Trade and Prices.—Prices of the chief food grains show a slight upward tendency as will be evident from the following figures of average retail prices in rupees per maund at the end of the month as compared with those of the last month:

	End of May, 1938.	End of June, 1938.
Wheat	2·716	2·721
Barley	1·894	2·385
Gram	2·294	2·312
Rice	3·891	3·972
Arhar dal	4·464	4·489

IX—Health and Labour in Rural Areas.—Agricultural and labouring classes can find sufficient employment in fields. The death roll from cholera is reported to be high during the month.

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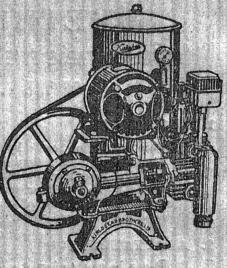

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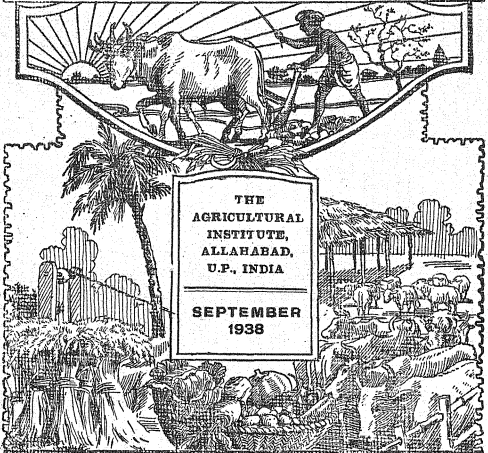
THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



THE
AGRICULTURAL
INSTITUTE,
ALLAHABAD,
U.P., INDIA

SEPTEMBER
1938

"Ye rigid Ploughmen, bear in mind,
Your labour is for future hours:
Advance—spare not—nor look behind—
Plough deep and straight with all your powers!"

RICHARD HENRY HORNE.

The Allahabad Farmer

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AND RURAL LIFE

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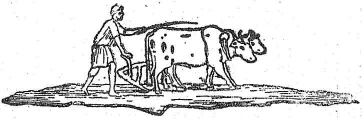

VOL. XII] SEPTEMBER, 1938 [No. 5.

An Editorial

Ethical Implications of Farming.

One of the outstanding developments of the past fifty years has been the extension of personal ethics to include a great many business and social relationships which previously had not been considered as having moral significance. Our definitions of stealing, of murder, of false witness, were clear. Relationships in business were still considered as though they were between one man and another, face to face. The distance to which one's man's actions could have an effect was limited by isolation and slow communications.

These things have changed now. A great deal of the business of the world is conducted by great limited companies and corporations. The Bombay market deals in ownership in companies operating in England, Germany, France, the United States, and many other countries. Rapid and cheap ocean freight puts Argentine wheat in London, New Zealand, butter in Paris, Indian jute in Europe and North America, Japanese silk in all the ports of the world. The trade of the world is often between people who have never seen each other. New generations grow up to use, without thinking much about them, the methods and

the systems of their fathers. And in the past fifty years we have been increasingly recognizing that many of the practices of our business life are as harmful, morally, as stealing, that murder can be, and is being done, by most of us in some of the ways in which we use our money, as surely as it is ever done by a hand or firearm, that it is as correct to label much of our advertising "false witness' as to apply the name to personal speech.

Just as in all other walks of life, one engaged in agriculture is involved in all sorts of transactions which have a right and a wrong solution from the standpoint of society as a whole. How do I use my land? We are coming to see that it is a crime against our fellow-men if land is used selfishly, improperly, without regard for the consequences. We are coming to believe that land belongs to society, and that if we are to have "private property" in land, it must be in the sense of trustee-ship rather than absolute right. What crops do I raise? Are they crops needed by society, or only the crops which will bring me the highest returns? Where do I sell my crops? In an open, free market, or behind trade restrictions which give me an unfair advantage over some other farmer? How do I use my income? What effect for good or ill does it have when I choose between two possible purchases, when I ponder how to use any surplus income I may have, when I pay those who work for me?

The world in which we live has become a very intricate world. It is a common place today to scorn those who profess high religious ethics, but who fail to appreciate or to practise personal morality in these organized relationships of life. We are worse than hypocrites unless we recognize to what an extent each of us is guilty in these matters, and how difficult, and yet imperative, it is to find the correct answers.

There is an ethics of agriculture. We shall be unprofitable servants of our generation until we learn and follow it.

A. T. Mosher,

(Formerly an Editor of The Farmer)

ON THE RECLAMATION OF "USAR" LANDS.*

BY

C. MAYA DAS, I. A. S.

Deputy Director of Agriculture, Sarda Circle, U.P.

You have all heard of "usar". Some of you have also heard the expressions "banjar" and "parti". These are all phrases describing different classes of land most of which is available for profitable cultivation if treated as I will presently describe. This method of treating these so called waste lands was unknown two years ago.

As we go along in the railway train we watch idly, large expanses of waste land. It seldom occurs to us that of this type of land there are no less than 154 million acres in India. In the United Provinces which has a total cultivated area of 68 million acres, there are 8½ million acres of culturable waste land. A very small part of this area was at some period cultivated and has now been abandoned for one reason or another. The greater portion, however, is land which the cultivator with his limited experience considers incapable of yielding a profit under his methods of agriculture In this view he is justified and this has been the experience of others before him. By a modification of the cultivator's method, however, it has been found possible to deal with such land and to make it yield profitable crops, with nominal outlay. This was a chance discovery some two years ago while we were engaged in agricultural development under the Sarda Canals. It struck me then that with the rural areas multiplying in population almost as rapidly as do rabbits, something must be done to prevent a future food shortage. The present population of the United Provinces is about 49 millions. This large number of human beings feeds on a total area under food crops in these Provinces of 38 million acres. Thus if the above 8½ million acres of culturable waste land could all be put under food

* A broadcast from the Allahabad Agricultural Institute Radio Station, 13th July, 1938.

crops, it would support an additional population on this basis, of $6\frac{1}{2}$ million people.

In the *kharif* (rainy season) of 1936 we tackled all sorts of waste land, even the so-called unculturable waste under the common name of "usar". Anticipating that any successful method of reclamation must be cheap enough to be considered by the poor villager, the method adopted was as simple as possible. This method is now practised by a large number of *zamindars* and cultivators, and, in at least one case, an educated unemployed youth who had little or no capital to start with. The success that resulted in making such land yield good crops both during and after the rains, has been very encouraging. It almost looks as if we have found, at least under canal irrigation, the goose that lays the golden egg. The proof of the pudding is in the eating and the appetite of *zamindars* for reclaiming waste land under the Sarda Canals is increasing every day. The canal officials have been kind enough to supply water free of charge for such ventures and the staff of the Sarda Agricultural Circle are available for advice.

The method or reclamation is simple. We first get canal water on to the land by making low embankments, 6 to 9 inches high, round fields of convenient size. After a few days we run off the surplus water and when the land is ready for the plough, we plough it with a Meston, Gurjar or other soil inverting plough. The deeper the ploughing the better. This process of alternate watering and ploughing goes on during April and May. After three such treatments we are generally ready to broadcast sunnhemp seed and to let it grow up to near the flowering stage and then plough it in. Should the soil be so alkaline as to make this crop come up patchy, over these patches we apply liberally any available manure such as village waste, cattle dung or compost. The process of ploughing proceeds, but further watering is delayed until the planting of paddy which is the next iteam in the plan of reclamation. We have found that paddy types 21 and 23 are resistant to soil conditions found on culturable waste and give excellent results. Type 23 does well where the soil is heavily alkaline, commonly

called "usar". Transplanting paddy seedlings is better than broadcasting the seed. In this way the very first year we have had remarkable crops of rice followed in most cases the same year by a fair crop of barley. The net profit is perhaps small the first year, but substantial during the second year. A cheap pair of bullocks for about 8 acres together with a plough will cost about a hundred rupees and such waste land can be had at a nominal rent of a few annas per acre. About 30 acres should support a family of unemployed persons in reasonable rural comfort.

The secret of this method lies in alternate watering and deep ploughing with a run off for surplus water. This helps to wash out certain injurious salts which in the United Provinces seem to be present in large quantities in culturable waste land Repeated watering, ploughing and manuring prepares the field for the first paddy crop. The green manure crop, before the paddy, gives a good indication of the quality of the land for agricultural purposes. After the early paddy is removed in September, the land is again watered and ploughed and prepared for the winter crop. Barley generally does best the first year but oats, peas and *berseem* (Egyptian clover) have been tried successfully. During the second year the early paddy may be followed by wheat if soil conditions permit of this. This is possible and more profitable in some cases We have on cultivators' fields had as much as 23 *maunds* (82lbs. equals one *maund*) of paddy per acre the very first year, and 10 to 15 *maunds* per acre of barley as a second crop. To the agriculturist who looked upon these lands as useless, these results are amazing. Nevertheless, believe it or not, they are easy to achieve.

In the present struggle for existence and the growing strength of the army of unemployed educated young men, the fact that eight and a half million acres of culturable waste land is waiting to provide profitable farming for 6½ million people which this land can support, is indeed food for thought for the economist and politician alike.

(*Continued on page 195*)

PRE-CAST UNITS IN REINFORCED BRICK CONSTRUCTION

By

MASON VAUGH

Agricultural Engineer, Allahabad Agricultural Institute

The cost of the necessary form work material (centering) is an important item in the cost of any building. Not only must the material be purchased in the first instance but it must be erected and dismantled, stored and moved from job to job at considerable cost. Depreciation is high as there is much breakage, cutting and loss by decay Storage under cover is rarely available until the last stages of a new building. With the general lack of fuel and its high cost, such material is a constant temptation to workmen and neighbours as well as the casual passerby and it has a tendency to "evaporate" slowly unless very strict watch is kept.

Time is also an important factor in building construction. Slab construction has this disadvantage as compared to jack arches that the arch centering can be constructed as soon as the arches are completed or in a day or two at most. Slab forms or centering must be left till the cement has set and hardened to sufficient strength With reinforced brick work, this is a shorter time than for concrete because of the better control of water—cement ratio allowing of higher early strength. Even so, slab centering must be left in place from a week to two weeks or longer to ensure safety.

With these factors in view, the Institute building crew undertook to experiment with the possibility of using pre-cast slabs for roof work on two new bungalows under construction recently. The first slabs made were used on verandahs and over bathrooms with a clear span of 8 feet. This necessitated slabs 9 feet to 10 feet in length to give the necessary bearing in addition to the clear span. Similar slabs were also made and used for two ground floors where basements were made under the rooms All slabs so far made have been of brick on edge, making slabs $4\frac{1}{2}$ inches thick.

The first slabs made were 8 courses wide and 10 ft. long. giving a width of just over 2 ft. This was calculated to be the largest slab that could be handled by hand or with simple crane equipment. It was found feasible to handle slabs of this size at the ground level, but they were rather too heavy to be handled readily by 8 men and the use of additional men was found difficult Later slabs therefore have been made only 6 courses wide making a slab about 20 inches in width. These are handled fairly readily by 8 men, even when over 10ft. in length.

After some experimenting, the following technique was worked out. The slabs were made entirely without forms. A suitable place was levelled off near the building under construction, as near as conveniently possible. Bricks were placed to give the required slab size and grouted with 1 to 3 cement-sand mortar. The slabs were made up-side down to allow the tension reinforcing to be put in the top of the mortar joint at the time of grouting. We found that when the slabs were made right side up, the steel was not always correctly placed. Longitudinal reinforcing is used according to requirements of span and load. Each slab also carries 4 cross rods, usually 3/8 inch in diameter, with a hook bent on each end of such a length that the hooks project out of the slabs 4/3 inch to 1 inch, on each side. This work can be carried out leisurely by one or two men well in advance of the time when the slabs are needed.

After being allowed to harden for at least 5 days, the slabs are turned over and carried on edge to the base of the crane. For carrying, the best results were secured with a crew of 8 men, 4 working at each end of the slab. Rope slings with hooks on the ends were passed round the slab after it was raised on to its edge, a piece of strong bamboo about 6—8 ft. long passed through each rope and two men lifted on each end of each bamboo. With 6 course slabs, they are able to walk right along to position. The slabs are placed right side up and a chain sling put round each end at about the quarter length points. The two slings are connected with a short chain in which the crab winch hook is fastened.

Lifting is done with ordinary crab winch. Ours is fitted with steel wire rope. A stout wooden pole about

10 ft. longer than the height to which the slabs are to be raised as used. A pulley is fixed at the top for the lift and one at the base to change the direction of the rope from vertical to horizontal. The pole is guyed with ropes in 4 directions. The lifting only takes a couple of minutes. When the slab is well above the top of the walls, the guy rope away from the side where the slab is to be placed is loosened and the pole allowed to lean over till the slab is above its location when it is lowered into place. The pole is walked forward as slabs are placed, usually 3 or 4 slabs being placed from each location. At the end, two or three slabs are hoisted and placed on the others to get room for the hoisting. After the pole is removed, they are readily slid into place. Usually 2 men stay aloft to place the slabs. Such a crew of 10 men can place 15 or more slabs a day, without driving hard.

The slabs are placed as close together as the hooks allow and an iron rod, usually $\frac{1}{4}$ inch in diameter is put through the hooks This is merely to tie the hooks and the slabs together. This leaves a crack a couple of inches wide between each two slabs. A plank of some sort is put beneath the crack and supported with a couple of poles and the crack is filled with concrete. As the cracks are so narrow, these supports can be taken down after 3 or 4 hours. This filling of cracks can be done just after the slabs are placed or the next day. Only enough equipment for use under 4 or 5 cracks is needed as by the time that many are filled, the first can be taken down and moved ahead. After the crack filling is set, usually the next day, the tops of the slabs are well cleaned and whatever surface finish is desired can be carried out immediately. We prefer cement plaster but lime concrete terracing or other surfacing can be used as may be desired.

In this way, a verandah roof can be put up and be ready for plastering on the under side in little more than the time required to put up the centering as it is ordinarily done. Plastering can easily start the third day after slab placing is begun, if it is desired to do so. Nearly two weeks is required to erect centering, lay slabs in place, allow them to

harden and then to strip them. Our figures show that the labour for making the slabs and erecting them is just about that required to carry the bricks and mortar up and to lay the slabs. In addition to speeding up the work practically the whole labour and material cost of centering is saved.

In addition to economy of time and cost, this method appears to give another definite advantage. All slab roof construction has been under the disadvantage that contractions in the setting of cement has resulted in cracks unless expansion joints were rather liberally provided. This method allows most of the contraction to take place while the slabs are still on the ground and so results in a more stable slab. At least, initial strains due to the contractions incidental to the setting of the slabs do not result in pulling it apart soon after construction No roof has been long in service. Those buit so far have given less trouble then previous roofs made by the older methods.

(*Continued from page* 191)

I will be glad to advise any one wishing to undertake the cultivation of culturable waste land for a living. If you have no capital, you can perhaps borrow five hundred rupees to begin with. You must be prepared to rough it in a thatched hut out in the wilds, but the occupation is not only paying; it is full of health and pleasant surprises. If you can begin with a larger initial sum there are prospects of successful farming as a profitable business. If you want to see how it is done, get into touch with the Senior Agricultural Inspector at Unao and he will show you what other people are doing near Unao and away in the distant villages. It is a great life and we would like to see educated young men take their coats off, roll up their sleeves and get to work as land reclaimers. It would be good for the backward rural masses to come, in this way, into close contact with educated men from the towns and *vice versa*. It is not a hobby, that I have briefly tried to describe. Far from it. It is an occupation that brings in substantial returns on small investments. Patience and a willingness to work hard-these are essential to success.

THE USE OF STATISTICAL METHODS IN CULTIVATION EXPERIMENTS *

BY

B. M. PUGH AND L. A. KHAN.

While statistical methods have been used for a long time in biological experiments and more especially in connection with genetical problems, their use in soil and cultivation experiments is of a comparatively recent date. The development of the analysis of variance by Dr. R. A. Fisher, formerly of the Rothamsted Experiment Station, has made possible the wider use of these methods in field experiments of all kinds. Thus field experiments based on Fisherian principles are now fairly common all over India. The Allahabad Agricultural Institute has also fallen in line with all other institutions and has at present well laid out crop experiments based on the most up-to-date statistical methods. In order to explain to our readers the use of these methods in connection with cultivation experiments a very simple randomized block layout will be explained herewith.

It was decided to find out the effect of cultivation or no cultivation on our *jowar* crop. This crop was chosen as it has been found to be more sensitive to external stimuli than most other crops that are grown on our farm. It was therefore decided to find out as to which one of the following three "treatments" will give the best results:

1. All the weeds from the plots were to be removed and the soil was to be constantly stirred up in order to create what is popularly known as a soil mulch.

2. The weeds were to be removed by hand without stirring the soil.

3. The weeds were not to be removed at all.

It was also decided that the effects of these three treatments were to be tested by a randomized block layout. This consists of having several replications or repetitions of the same

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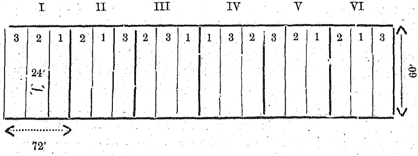
treatment in the field. It was decided to replicate six times. In other words it was decided to have 18 plots in the whole experiment. That is, each of the three treatments was repeated six times. The whole layout for the experiment was then divided into six blocks, each block consisting of 3 plots which were treated differently as explained above, The three treatments were then randomized in the three plots in each block. This was done by numbering the three treatments as 1, 2, and 3, and the three numbers were then put into a hat and each number was then picked up. The number that came first was put into the first plot in the first block, the number that was picked up next was put into the second plot of the same block. And as there were only three treatments, the remaining number was allotted to the third plot of that block. This process was continued with all the other blocks. And the result of that randomization was as follows:



The blocks are herein numbered in the Roman characters and the treatments in Arabic.

The size of the whole layout was 432′ × 60′ and the size of each block was therefore 72 × 60, and the size of each plot 24 × 60.

The seed was sown by broadcasting throughout the whole area at the usual seed rate for fodder *jowar*. The germination was observed to be fairly uniform throughout this whole layout. There were two weedings during the period of growth in plots numbered 2 and 3. When the

crop was ready for harvesting it was cut plot-wise and weighed. The data obtained were then tabulated as follows:

Weight of Green Fodder.

Treatments:	Block I	II	III	IV	V	VI	Total.
1	173	200	138	197	230	205	1143
2	263	227	272	178	267	262	1469
3	320	255	197	203	335	264	1574
Total ..	756	682	607	578	832	731	4186

As shown above, from the data obtained, the total for each treatment as well as for each block was calculated. Thus the first treatment, that is the unweeded plots, gave a total yield of only 1143 seers, the second or the plots where weeds were removed by hand gave a total yield of 1469 seers, whereas the mulched plots gave a total yield of 1574 seers. In the same way, by adding up the yields of the plots in each block the totals for each block were obtained. These totals also were shown in the above table.

The next step in the process was to find the total sum of squares. This refers to the sum of the squares of the deviations in the yield of each plot from the mean yield per plot in the experiment. And the mean yield per plot is $4186 \div 18$, that is the yield of the whole layout divided by the number of plots, which is equal to 232.6 approximately. The total sum of squares may therefore be obtained thus :

$$(173 - 232.6)^2 + (200 - 232.6)^2 + (138 - 232.6)^2 + \ldots \ldots\ldots(264 - 232.6)^2.$$

This gave a total of 44892.5. However for arriving at this result two other methods of calculation are sometimes used as these make the calculations easier. One of them is to square all the plot values, add them and then

from the total substract a value obtained as follows :

$$\frac{\text{The square of the grand total}}{\text{Number of plots.}}$$

The above is commonly known as the correction factor.

The total sum of squares might then have been arrived at as follows:

$$(173)^2 + (200)^2 + \dots + (264) - \frac{(4186)^2}{18}$$
$$= 44892\ 5$$

Similarly, following this method, the sum of squares of deviations due to treatments was obtained as follows :

$$\left[\left((1143)^2 + (1469)^2 + (1574)^2\right) \div 6\right] - \frac{(4186)^2}{18} = 16836\ 8$$

Or in other words the sum of squares of the treatment values was divided by the number of plots per treatment and from the result thus obtained a correction factor was subtracted The sum of squares due to treatments which is 16836 8 was thus arrived at

In the same way the sum of squares of deviations due to blocks may be found out as follows :

$$\left[\left((756) + (682)^2 + (607)^2 + (578)^2 + (832)^2 + (731)^2\right) \div 3\right]$$
$$- \frac{(4186)^2}{18} = 15115\ 1$$

From the above calculations we therefore see that the sum of squares due to treatments and that due to blocks is 16836.8 + 15115.1 or 31951.9. But the total sum of squares is 44892.5. Therefore the remainder, that is 44892 5 — 31951.9 or 12940.6 is the sum of squares due to the other factors which are not accounted for in this experiment. This sum of squares is generally considered to be due to error.

The next step in the process was to find the mean square or, what has been termed by Dr. R. A Fisher, the "variance." This is obtained by dividing the respective

sums of squares by what are known as the "degrees of freedom." This term refers to the number of values of each of the components to which the sums of squares are assigned less one. For instance, the sums of squares are now assigned to blocks, treatments and error; and these three components make up the total sum of squares. And as the number of blocks and treatments are 6 and 3 respectively, the number of degrees of freedom due to blocks is 5, that is 6—1, and the number of digrees of freedom due to treatments is 2, that is 3—1. In general, however, the number of degrees of freedom is the total number of values of each of the components less the number of constant values given to each of the components. Now, therefore, the mean square due to blocks is $\frac{15115.1}{5}$ or 3023.2, and the mean square due to treatments is $\frac{16836.8}{2}$ or 8418.4. Again since the total number of variates or, in this case, plots in the whole experiment, is 18, the total degrees of freedom is 17. Hence the degrees of freedom due to error is 17—(5×2) or 10. Therefore the mean square due to error is $\frac{12940.6}{10}$ — 1294.1 (approximately).

Now, Fisher's method of testing significance is by the help of a formula.

$$Z=\tfrac{1}{2}\log_e\left(\frac{s_1^2}{s_2^2}\right)$$

$$\left(=\tfrac{1}{2}\log_e s_1^2-\log_e s_2^2\right)$$

Log_e denotes the natural logaritim, which may be obtained from tables giving this function or by multiplying $\log_{10}$ by 1.1513. Now $\log_{10}$ of 3023.02 is 3·4804, $\log_{10}$ of 8418.4 is 3.9252, and $\log_{10}$ of 1294.1 is 3.1119. Each of these when multiplied by 1.1513 gave 4.007, 4 520 and 3.541 for blocks, treatments and error respectively. The value of Z for blocks is 4.007—3.541 or .466, and the value of Z for treatments is 4 520—3.541 or .979. Fisher has provided tables of the distribution for the probability points P=0.05

and $P = 0.01$. These two levels of significance refer to the probability that the inferior treatments would exceed only once in twenty times on the average and once in a hundred times respectively.

In looking up these tables in Fisher's book it was found that when n_1 is 5 (degrees of freedom) and n_2 is 10 (degrees of freedom) the value of a 5 per cent probability is 0.6009. The Z value due to blocks as obtained in this experiment is only 0.466 which is less than 0.6009. Therefore the data show that there is no real or significant difference due to blocks. On the other hand, from the Z table we see that when n_1 is 2 (degrees of freedom) and n_2 is 10 (degrees of freedom), then the 5 per cent value is .7058 and the 1 per cent value is 1.0114. Therefore the Z value ·979 due to treatments shows that there is a 5 per cent level of significance in the treatments, but not a 1 per cent level.

Another step in the process was to find out what is known as the standard error of the totals of the three different treatments. This is equal to the square root of the product of the variance for a single plot due to error and of the number of plots per treatment. That is,

Standard error of the yields for 6 plots:

$$= \sqrt{\text{Variance for a single plot} \times 6.}$$

$$= \sqrt{1294.1 \times 6.} = 88.119.$$

Again the standard error of difference between two treatments was obtained by the help of the following formula:

$$E_D = \sqrt{2 \times E^2} = \sqrt{2} \times E.$$

Where E_D represents the standard error of the difference between the values of the treatments and E represents the standard error. This is equal to $\sqrt{2} \times 88.13 = 124.6.$ In order to find out what value is necessary in order that a difference between the treatment values may be considered significant or real, Fisher has worked out a table called a 'table t' which gives the values of $\frac{D}{E_D}$ (where D is the value of the significant difference between the values of the various treatments). In looking up this table it was found that in the

5 per cent column and opposite the n value of 10 (number of degrees of freedom due to error) a value of 2.228 is given. This is the value of $\frac{D}{E_D}$ for a five per cent level of significance.

$$\therefore\ D = 2.228 \times E_D$$

Hence in the experiment, the significant difference was 2.228 × 124.6 or 274 approximately. Taking the treatments values 1574,1469 and 1143 one therefore will find that there is no significant difference between the first and the second treatment values, but that there is a significant difference between the values of the third treatment and any of the other two as the difference is greater than 274. This may therefore be shown as follows:

Mulched	Weeded	Unweeded.
1574	1469	1143

In order to enable the reader to follow the steps in the process the following tables showing the different steps are given herewith.

TABLE 1. Showing yields of plots in different blocks due to different treatments.

Treatments.	Blocks.						
	I.	II.	III.	IV	V.	VI.	Total.
Unweeded ..	173	200	138	197	230	205	1143
Weeded ..	263	227	272	178	267	262	1469
Mulched ..	320	255	197	203	335	264	1574
Total ..	756	682	607	578	832	731	4186

Correction factor $= \frac{(4186)^2}{18} = 973477.5$ ... ... (*a*)

TABLE 2. Showing the squares of the yields values in Table 1.

Treatments.	I.	II.	III.	IV.	V.	VI.	Total.
1	29929	40000	19044	38809	52900	42025	222707
2	69169	51529	73984	31684	71289	68644	366299
3	102400	65025	38809	41209	112225	69696	429361
Total ..	201398	156554	131837	111702	236414	180365	1018370

Sum of all squares = 1018370

Total sum of squares = 1018370 − 973477.5

= 44892.5 . ... (b)

TABLE 3. Showing the block and squares of their values.

Blocks.	I.	II.	III.	IV.	V.	VI.	Total.
Block total..	756	682	607	578	832	731	4186
Squares	571536	465124	368449	334084	692224	534361	2965778

Total of squares = 2965778

This divided by No. of plots per block = $\frac{2965778}{3}$ = 988592.6

From this subtract (a) = 988592.6—973477·5.

= 15115.1 ... ... (c)

TABLE 4. Showing the treatment totals and the squares of those values.

Treatments.	I.	II.	III.	Total.
Treatment total ..	1143	1469	1574	4186
Squares	1306449	2157961	2477476	5941886

Total of squares = 5941886.

This divided by the number of plots per treatment $= \frac{5941886}{6} = 990314.3$.

From this subtract (a) $= 990314.3 + 973477.5$
$= 16836.8$ ... ... (d)

The sum of squares due to error $=$ (b) $- (c + d)$
$= (44892.5) - (15115\ 1) + (16836.8)$
$= (44892.5) - (31951.9)$
$= (12940.6)$ ... ... (e)

TABLE 5. Analysis of variance.

Due to	D.F.	S. S.	Mean. Square	Log 10	½ $\log_e$	Z.	Level of significance.
Blocks	5	15115.1 (c)	3023.02	3.4804	4.007	.466	Not significant.
Treatments	2	16836.8 (d)	8418.4	3.9252	4.520	.979	5% significant.
Error	10	12940.6 (e)	1294.1	3.1119	3.541	..	..
Total	17	44892.5 (f)	..	..	..	..	..

Standard error for 6 plots (total plots per treatment)
$= \sqrt{\text{Variance for a single plot} \times \text{No. of plots per treatment}}$
$= \sqrt{1294.1 \times 6}$
$=$ 88 119.

Standard error of difference between two treatments
$=$ Standard error $\times \sqrt{2} = 88.12 \times \sqrt{2}$
$= 124.6$

Significant difference $= 124.6 \times 2.2 = 274.12$

Hence we arrived at the following conclusion :—

Cultivated	Weeded by hand	Mulched
1574	1469	1143

Conclusion:—This article was written not with a view to show the superiority of one of the treatments over another, but more especially to encourage students of agriculture to learn the proper technique of experimentation; so not much importance should be given to the conclusions arrived at although the figures are taken from an experiment actually carried out where other data besides yield were taken.

In order that students may better comprehend the theory involved in the methods outlined above, they are recommended to read further, as we know how inadequate this article is in order to make the subject matter clear to them. For a beginner the most elementary treatise known to us on this subject is a series of articles by D. D Patterson published in *Tropical Agriculture*, Trinidad, British West Indies. After having read this, a student may then read another book on the Principles and Practice of Field Experimentations by Wishart and Sanders. Then perhaps he is ready for other books of a more advanced nature. But one should try to understand Fisher by reading his books of which, we know, two are in the market.

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HOW TO GROW ONIONS

By

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Farmers are now realising the fact that they must give more attention to diversified farming in order to balance their returns from widely fluctuating markets. They further realise that the cultivation of cereals and fibres alone cannot bring a good income to them, and recourse to other crops ought to be taken in order to maintain a minimum standard of living. But the curious customs and orthodoxy prevalent among the higher caste Hindus do not allow them to grow such crops and this is the chief cause of their poverty. The departments of the Government cannot bring relief to the suffering tenantry, so long as they do not cultivate the habit of growing such crops among them.

Onions are one of such crops and are being grown with success in India. The demand for this crop is ever increasing with the civilization of the world, and the onion which was once treated with hatred is now taken with interest. It is an important crop having varied uses and is equally demanded by the rich and the poor, the young and the old.

This article is especially written to show the readers the present day scientific and practical cultivation of onions and the profits derived from it. Onions will be found to yield good crops, and the labour involved is light, so that any man with his family to assist him can well manage a reasonable area. The cost of planting is light and the market is usually assured in almost all parts of India. One particular point about the cultivation of the onion is that it does not take much out of the soil, and provided disease is not troublesome, it can be grown on the same land successfully several times

Climate.—Onions can withstand a considerable degree of heat provided it is accompanied by a certain amount of

moisture, and continue growing when many other vegetable crops are suffering. Given proper soil and treatment, onions should be a success in most localities where general farming is done. Onions are very impatient of wind in their earlier stages, but recover and make rapid growth under the influence of warmer conditions. They can be successfully grown on the land with a climate suitable to potato growing, excepting cold highland where this crop fails. On the other hand onions can be grown with irrigation facilities in districts too hot for the potato. In fact onion can grow anywhere, if given a little extra care and attention.

Soil.—Although any soil not actually poor will give a fair crop, the land must not be ill-drained. Onions succeed well and attain a milder flavour on rich soils. The most suitable soil for onion cultivation is a heavy loam, deep and mellowed by careful cultivation. Heavy and clayey soils produce an onion with a strong skin and great substance and solidity of flesh. The land chosen for onion cultivation should have been previously well worked out and freed from weeds, for otherwise it will entail heavy expenses in clearing the crop and will cause loss through smothering of the young plants Fallowed land is sweet land and can give a good onion crop.

Preparation of land for the crop.—Plough the land deeply and then harrow well so as to break all the clods and ensure a firm bottom. The land for onion cultivation ought to be ploughed twice or thrice with the Meston or Watts plough during the rains and three or four times with the *desi* (local) plough in the ensuing months to make the soil friable and free from the weeds. It would be an advantage if the land be made ready as early as possible, so that in the event of small weeds making an appearance, the harrow can be again passed over, thus saving much labour later on in the weeding.

Manuring.—Soils and climatic conditions differ so widely that no hard and fast rule can be laid down regarding the kind and quality of the fertiliser. Generally 25 to 30 cart loads of well rotten cow dung manure does well for this

crop. After the time of sowing, an addition of about 15 maunds (one maund is 82 lbs) of castor cake per acre brings an additional advantage. But the grower must be guided very largely by what experience has shown to be most suited to his district. However, certain broad points should be borne in mind. The onion is not a heavy producer of green top growth and hence will not stand over feelding with nitrogen. This element tends to make them thick-necked and spoils the solidity and the keeping quality of the bulb. Again the presence of much rich animal manure will probably adversely affect the shape and skin of the bulb, making the skin soft and spoiling the dry parchment skin, which affects their keeping quality and make them less resistant to disease The onion generally seems to be a fairly sparse feeder and for this reason all kinds of over-feeding are to be avoided. On the other hand, if the soil is difinitely deficient in any element which they require, they will not be able to attain their full growth.

In the recent trials at the Bathurst experimental farm in Australia, results from fertilizer tests seem to indicate that sulphate of ammonia is of very little benefit to the crop and potash hinders rather than assists development. Excellent results were obtained from the use of super-phosphate and it appears that this may be used up to four maunds per acre with advantage. It appears that for soils rich with humus and in nice loamy condition a dressing of super-phosphate up to 3 to 4 munds per acre is desirable. If the crop be seen to be weak, sulphate of ammonia would no doubt stimulate the crop, but too heavy a dose will probably make the bulbs soft. This manure should be applied between the rows, for otherwise it will harm the plants.

In the end, farm-yard manure is the best manure for the field of onions as it gives all kinds of ingredients to the crop and is available to all kinds of tenants.

Quality of Seed.—Here one must stick strictly to the reliability of the seed. One may comply with all the conditions of soil, climate, and cultivation, but the inferiority of seeds will bring him disappointment in the end. A good

instance is of a mixture of kinds which will give irregular ripening of the crop and will give a crop unsuitable and unprofitable. The seed selected must be of a good strain and of known pedigree and must be purchased from reliable seed depots.

Patna is famous for its onions and the two acclimatised varieties available from here are strongly recommended for the plains. One is known as the silver-skinned onion and the other the red-skinned onion. Imported seeds are apt to fail as they do not keep well. However, the following Australian early and late maturing varieties are recommended to the market growers. The very early types are the early Barletta (flat white) and Hunter River early white and brown. The very late variety is represented by the long keeping brown Spanish type. This type can be stored for a fairly long period. But this type requires a rather cold climate and the provinces with a milder climate can grow well, the early maturing types. Generally speaking, the earlier an onion matures the less is the keeping quality. The only good in this type lies in the fact that it can command high prices in the market.

Sowing.—Seed should be sown in the month of September or October in well prepared and well drained, but not in over-fertilised soil. Any ordinary good soil will be sufficient to raise the plants without the addition of any artificial manure, but a little mulch in the form of leaf mould or very well-rotten animal manure is all that is required. Two to three pounds of seed is enough for an acre, if drilled, and about 1½ pounds when sown in the beds and transplanted into the main plot. Sowing by drills offers great advantage in the easier working of the crop for hoeing and weeding purpose When drilling onion seed in the permanent plot they should be sown in drills 9 to 10 inches apart and to a depth of half an inch to an inch according to the nature of the soil. The running of a light harrow over the area in the same direction in which the drills are sown, a few days after, will tend to cover any seed that may be too near the surface and leave a nice loose mulch on the soil.

Transplanting.—Transplanting onions will be found a good plan for those who have no good seed drills, and is accomplished by sowing the seed thinly in a bed and when the plants are three to four inches high, planting them out at the required distance. The cutting down of the green leaves is not necessary. Choose always cool, moist weather to move the plants and particularly avoid winds.

Cultivation and Weeding.—It is very necessary to hoe the field and to remove all the weeds. The seedlings will become suitable for hoeing four or five weeks after sowing. As soon as they can be hoed without covering them with soil, hoe for the first time, taking care not to tread the hoed area. Again hoe after a few weeks. Remove all the weeds that may be between the onions in the rows and take the opportunity of thinning the plants to from four to six inches apart. Repeat these processes of hoeing and weeding alternately. Should the land be fairly free from weeds, one hoeing will do. One thing to be noted in this connection is that the earlier the field is weeded, the greater is the probability of a fine yield, the plants thus growing on without a check. Now let the crop stand till ripe and harvest.

Watering.—The soil at the time of sowing the seed should be well-drained. Regular watering is then necessary till the crop is ready for harvesting. When the bulbs are ready for lifting, all watering should be stopped. Copious watering is however necessary when the plants are growing, otherwise "doubles" will be formed. When full grown only sufficient watering should be given to keep them alive. Over-watering at this stage tends to encourage thick necks instead of sound blubs.

Harvesting.—The time for harvesting is known by the tops changing colour and falling down. This time comes in the United Provinces in the months of April and May. Watering should be stopped at this stage and when the leaves are completely withered, the bulbs are ready to be taken out. Onions will keep and handle better if not too ripe when pulled out—that is, the tops still retain some of their orinigal sap. When ready, pull the bulbs by hand

or dig them out with a spade and keep them lying in the rows till all the leaves are withered. Now remove the leaves and the bulbs are ready for bagging.

Storing.—The main thing in this connection is to keep the onions thoroughly dry with a good circulation of air. They should not be laid too thick, where air cannot have free access. Dry grass or straw makes a good bed on which to keep the bulbs for storing. The blubs should be completely ripened and dried before they are stored.

Thick neck.—This is an indication of onions tending to run to seed without forming a proper bulb. The formation of thick necks may be due to (1) over-watering as already pointed out, (2) sowing the seed out of season, either too early or too late or (3) their being forced too much by nitrogenous manures. It is a debatable point whether this tendency can be checked by bending over the top just above the bulb. Latest experience, however, seems not to support the practice, as being of any material value.

Out-turn.—If properly cultivated and cared for, the yield goes as high as three hundred to three hundred and fifty maunds per acre. If the yield be sold for a very nominal price of one rupee per maund, the income will go as high as three hundred to three hundred and fifty rupees per acre, which is a fairly good income. This income will include the cost of cultivation also, which is not high—rent, manure, price of seed and water rate being the only expenses in addition to the labour of the tenant and his family.

Do you know that a century ago it took 83 out of 100 workers in the United States to produce farm crops; to-day, with machinery, 17 out of 100 are sufficient?—*Science News Letter*.

PROBLEMS OF THE INDIAN SUGAR INDUSTRY

By

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India has many natural advantages for the growing of sugar cane and the development of a sugar industry, e.g. cheap labour, suitability of climate and an extensive ready market. Despite these advantages the country has found it very difficult to compete with Java and other sugar producing countries of the world. One of the reasons seems to lie in the fact that due to improved methods of agriculture and intensive cultivation, the land in Java and other countries yields on an average 50 tons of sugar cane per acre; while in India, due to the proverty of the cultivator, and the antiquated methods of agriculture, even the most fertile land does not yield on the average more than 10 to 20 tons of cane per acre. Of course Java has also a better climate than India for the production of sugar cane. If India is to compete successfully with Java and other sugar producing countries she must abandon her antiquated system of growing sugar cane and manufacturing sugar and adopt the latest methods of handling cane both in the field and in the factory. It has been estimated that recovery of sugar from sugar cane has increased from 6.5 per cent. in 1919 to about 9 to 10 per cent. in 1936, but we are still far behind Java and Hawaii, which ordinarily recover 12 per cent. of the weight of sugar cane.

Further development of the sugar industry and its capacity to stand the economic competition of foreign countries remain now mainly an agricultural problem, and as Mr. N. Deer says: "Efficiency in equipment and in operation of factories combined with organisation of supplies is likely to be stultified, unless supplies of raw material of good quality are available at a price at once attractive to the grower and economic to the miller".

There is a great need to undertake measures which will bring home to the cane growers the need of improving the methods of cane cultivation. The cultivation of cane in India unlike other countries is in the hands of illiterate, small holders, who are very slow in adopting modern improved methods of cane cultivation. Moreover, the farmer is not aware of the improved methods of sowing and manuring, and left to himself simply carries on the process from year to year without worrying about improvements in quality or quantity. Improvement of the cane crop has been accomplished in Coimbatore which has brought out new varieties which are doing well in Northern India. The Coimbatore sugar cane breeding station has done much for the betterment of the Indian sugar industry.

Steps have already been taken to demonstrate improved methods of cane cultivation, and to supply for extensive distribution disease-free cane seed and to assist the organisation and operation of "development societies" among cane cultivators so as to enable them to get the greatest possible return. These schemes have been financed from the grant of the Government of India out of the sugar excise revenue. The United Provinces constitutes one of the most important sugar growing tracts of the world.

There has been a rapid increase in the acreage of sugar cane and hence in the quantity of sugar produced each year in India. The following table shows the number of sugar factories, the amount of sugar produced and the acreage under sugar cane in India:

Table I.

Showing the number of Sugar Factories, the amount of sugar produced, and the Acreage. and the total output of sugar cane in India.

Year	Sugar Factories in India			Sugar Production (whole India)			Total Acreage (acres)	Total canes (tons)
	U. P.	B. & O.	India	Factory (tons)	Refined from Gur (tons)	Khandsari (tons)		
1931 ..	14	12	32	1,58,581	69,539	2,50,000	30,76,000	4,33,16,000
1932-33 ..	33	19	57	2,90,177	81,106	2,75,000	34,35,000	5,11,29,000
1933-34 ..	59	33	112	4,53,965	61,094	2,00,000	34,33,000	5,24,55,000
1934-35 ..	65	34	130	5,78,115	40,000	1,50,000	36,02,000	5,43,46,000
1935-36 ..	68	34	139	6,84,000	40,000	1,25,000	41,41,000	6,10,00,000
1936-37 ..	71	36	156	7,60,000	40,000	1,15,000	43,00,000	6,30,00,000
(Estimated).								

The area under sugar cane in 1929—30 was 2,677,000 acres, and from this was produced 21,150 tons of sugar refined from *gur*. The number of factories crushing cane in 1928-29 was 24, in 1930-31 it was 29, and for the season 1934-35 it was 139.

"The Indian sugar industry had suffered from handicaps of low yields, poor quality cane, small scattered patches of cane cultivation, a land tenure system unfavourable to the establishment of compact sugar estates." The reason was that the greater part of the sugar cane area lay in sub-tropical India which has a short growing season with intense heat.

Gur or jaggery was made and used in India in very early times. The greater part of the sweet stuff used in India has taken the form of *gur*. *Gur* is a product, meant for direct consumption and can be termed as hard boiled massecuite. *Gur* is extensively consumed in villages. *Khandsari* (made by indigenous methods and therefore un-refined) sugar industry has also persisted in some parts of the country.

It should be added that the total production of sugar and sugar cane in India is always expressed in terms of *gur* and that in crop cutting experiments on which the standard yields are based, the yield of *gur* per acre, and not cane is recorded.

The revival of interest in the Indian sugar industry dates approximately from the commencement of the present century. The sugar industry unlike other industries has intimate connection with its fresh raw material *i.e.* sugar cane. Experimental work with the object of improving the indigenous processes of manufacture should be encouraged. In connection with this it should be added that the introduction of the centrifugal machine for making sugar which is really a notable advance, has been achieved.

The problems of the sugar industry may be summed up as follows:—

(1) Improvement of the indigenous industry.

(2) The production of the refined sugar which is now imported,

(3) The possibility of increasing the sugar cane growing tract in India.

The cane sugar industry differs from almost all other great industries in its dependence on regular and adequate supplies of fresh material. Most other industries connected with the processing of agricultural products can store at least part of their raw material for a substantial period, but in the case of sugar cane it is different So a high degree of co-operation is needed between the cane grower and sugar manufacturers.

If the Indian sugar industry is to develop or if even the existing area is to be maintained:—

(1) The improvement of the sugar cane itself is a fundamental necessity, better manuring and cultivation being hardly less important.

(2) Active assistance from the Imperial Government is amply justified in the national interest.

(3) Local Governments should be empowered to give financial assistance to pioneer factories.

(4) The most important thing to consider is the breeding of sugar cane and its acclimatization. The new hybrids formed should be disease-resistant, purer in juice and should possess a high sucrose content.

The Coimbatore breeding station is an ideal breeding station for the sugar cane crop, which has laid practically the foundation of the Indian sugar industry.

What sugar cane breeding has done in India for the sugar industry can be described by a few figures. In the year 1910, the best crushing cane for the sugar factories in North India was a thinnish cane, with a 9 per cent sucrose content yielding only 10 tons per acre, only fit for crushing for about 70 days. Now a group of canes is available, covering the period, November to April, yielding commonly 25 to 30 tons per acre, with a sucrose content

of about 11½ per cent. These are all hardy canes suitable for village conditions.

(5) Radical improvement in the raw material is neces sary in the interests of the indigenous *gur* making industry and of the indigenous sugar industry. Barber discovered *Saccharum spontaneum*, better known as *kans* grass, as a parent for the production of hybrid seedling canes for North India. In Java, a *Saccharum spontaneum* strain is now considered an essential element in the parentage of hybrid canes in order to ensure disease-resistance. But Northern India requires some cane which can combine high purity, high sucrose content, and early ripening with hardiness and a deep rooting habit, because pure juice is essential for the *Khandsari* sugar industry.

A Coimbatore cane, Co 213, which is one of the most widely grown in India has been for some time a standard cane for Bihar. This gives 11½ per cent of sucrose It can stand a wide range of temperature. The yield may go up to 40 tons per acre. This Co 213 is the result of crossing P. O J. 213 and Kansar.

(6) The problem of nitrogen supply in connection with cane cultivation and a practical system of green manuring and crop rotation should be worked out. This is being done .in the Sahjahanpur Government farm and also in Government farms in Bihar.

(7) More intensive cultivation of cane, that is, the application of more manures and fertitizers and also more frequent working up of the soil, is desirable.

(8) Research sub-stations are of great help for developing improved methods of cane cultivation. They can also improve the facilities for selecting new seedlings suitable for different provincial conditions. They can test new seedlings or hybrids on a co-ordinated plan, with growth studies and cultural and manurial experiments.

Some of these functions are now performed at the Imperial sugar cane breeding station itself and in other stations in Bihar and the United Provinces. A research

station at Mushari is tackling many problems for Bihar. For example, (1) they are trying to select a variety which will be an improvement over Co 213, (2) they are trying to select early and late maturing cane varieties so as to ensure cane supplies to factories from the middle of October to middle of May, (3) they are selecting canes with special reference to their rationing capacity and disease resistance, and (4) they are selecting canes suited to special growth conditions such as water-logged areas.

The full solution of all these agricultural problems will help in the improvement of the quality of canes and will also help the cane growers. And the improvement of the quality of cane, means improvement of the sugar industry. When these problems have been solved, the solutions can be recommended to cane growers.

A solution of these problems involves fundamental work on the following points:—

(*a*) Growth studies of a very large number of promising cane varieties in order to determine their optimum response to different phases of season and different soil conditions.

(*b*) Root studies in order to ascertain its development through different condition of growth, and also the type of root that gives the most successful growth.

(*c*) Chemical and bio-chemical investigations to ascertain the purity of juice, and environmental influences on ripening and juice quality.

(*d*) System of planting: This is the one of the most important problems. If it is proved that such and such a system of planting is the best then it should be recommended to the cane growers or practically demonstrated.

(9) There is yet another problem to tackle; the important question of securing to the cane grower a fair price for his cane. In many cases it has been seen that the price paid to the seller of canes has been unsatisfactory. Cane

growers, in general, were not receiving a fair share of the benefit of protection. The Sugarcane Act of 1934 has solved this problem successfully. The Act is fully working in North Bihar and in U. P., *i.e.*, in the areas which have the largest number of sugar factories. The Sugarcane Act is not in vogue in all the provinces.

(10) The question of transport is a very important problem. Pneumatic tyred bullock-carts will be the best and the cheapest on unmetalled roads. In some parts of North Bihar this practice is in vogue.

Conclusion

During the present time of agricultural depression, the sugarcane crop has been the one redeeming feature in thousands of villages of Northern India. It is at all times a crop which gives the Indian farmer a relatively large remuneration for his labour and service and gives him employment throughout the year.

The growth of the sugar industry, whatever its imperfection, has added substantially to the cultivators' resources. The solution of these agricultural problems on sugarcane cultivation will be a boon to the sugar industry.

REFERENCES:—

(1) A Paper of Lord Lindsay, presented at the meeting of the Royal Society of London.

(2) Sugarcane cultivation in Bihar and U. P. (1937).

(3) Report of the Scientific Investigation carried on at different experimental farms of Northern India.

"It is no mere form of words, but a fact, that the wealth of India lies in the villages."

SIR JOHN RUSSELL.

THE DRYING OF FRUIT AND VEGETABLES IN INDIA.

By

MRS. J. THIESSEN

G. C. M. Mission, C. P.

India is a land of extremes, first no rain, then too much rain; first no fruit, then too much fruit; first no vegetables, then too many vegetables. There are some months of the year when there are very few vegetables and fruits, whereas during other months there is often a supply larger than can be used. The problem is how to preserve the foodstuffs when there is a lot, so that there can be some available for the lean months.

The biggest source of power or energy that India has is the sun. His fees are nil. So we should make more use of the sun. For the average Indian people and boarding schools the most economical way of preserving fruits and vegetables is to dry them out in the sun.

Last year we dried carrots, peas, tomatoes, cabbage and cauliflower. Guavas can also be dried, and in our boarding school the housefather even dried egg-plant. There is no end to the list of possibilities.

Method of drying.—The cabbage is shredded very fine and then spread out in a thin layer on a large corrugated tin, *chatai* (a mat) or cot, and put out in the sun. The tin or *chatai* should be placed above the ground on a table or wall so that the dogs cannot reach it. The cabbage should be turned once or twice a day so that it will dry evenly. During the night the vegetables should not be left outside, because of the dew; if possible put them in a room. In about a week the cabbage gets dry like paper. Then it is ready to pack away in tin cans or earthen pots to keep.

The carrots are washed and peeled and then sliced as thin as possible, and put out in the sun. Every day they

must be stirred so that all sides get dry. These take about 5 days to dry.

The peas are taken from the pods and spread out on pie plates or *degchi* (pots) lids, and put out in the sun. Then it is easier to handle them so they do not roll away. In a week they are ready for packing.

The guavas or egg-plants are sliced as thin as possible and then dried out on a corrugated tin or *chatai*. These take slightly longer to dry. Be sure to turn them or they will stick to the surface.

The tomatoes can be dried in two different ways. One is to cut them up in slices, raw, and dry them like the other vegetables. The other method is to cook a *degchi*-full of tomatoes (without adding water) for ½ hour. Then take from the stove and strain out the juice with a sieve or fruit strainer or coarse cloth. This removes all the skins and seeds and only the pulp is left. Pour this juice into enamel platters or *degchi* lids to the depth of ¼th inch. Before the juice is poured in, the platters must be well greased. Then put these platters out in the sun and let this pulp dry. This takes about 5 to 7 days to dry and then it turns to a dark red colour. In case the weather gets cloudy or rainy when the tomato juice or other vegetables are only half dry, then it is best to put them into a kitchen in the warming closet of the stove. When the tomato juice is ready in the platters, it peels off the dish and looks like a piece of thin leather. These sheets of "leather" can be cut into strips or 2 inch squares. Pack them into a dry, clean fruit jar or tin box with a good lid, and use when needed.

The dried tomato juice is very good for soups, curries, as well as mixed with other foods. All the dried vegetables and fruits should be soaked a short time before they are used for cooking.

"In the keeping of village lies the cradle of the race."

RABINDRANATH TAGORE.

A SCHEME FOR A CO-OPERATIVE VETERINARY AID SOCIETY

By

A. N. Sanyal, Etawah.

It is a well known fact that cattle are a mainstay of the Indian cultivator. An increase or decrease of cattle population enhances or diminishes his property. An untimely loss of work cattle leaves him in a precarious position.

It is an unfortunate fact that in these provinces treatment of cattle epidemics is inadequate. So far, only the Government has been making an effort to do its best in this direction. The farmers have been sadly negligent about it, though they are now slowly taking to the modern system of treatment, especially injection.

It may not be out of place to mention that, single handed, the Government has not been able to do much up till now. The following scheme, however, has been prepared to enable the cultivators to join hands with the Government for the proper treatment of the cattle diseases and epidemics.

At present it is proposed to confine the work to the village *ghee* (clarified butter) societies of Etawah district which are vitally interested in milch cattle, and to find out the possibilities of the success of the scheme.

A Co-operative Veterinary Aid Society is to be formed and registered under the Co-operative Societies Act. All the *ghee* societies would, of course, join the proposed society and thus all individual members of the *ghee* societies would automatically become its members.

To start with, a Veterinary Society would appoint a trained Veterinary Compounder (or stockman as they call him in these provinces) whose duty would be to visit all the societies every month. He would work under the supervision and guidance of the Inspector of the Veterinary Department. In his visit to the societies he would examine and

treat all ordinary cattle diseases. For complicated diseases and epidemics he would report to the Veterinary Assistant in the nearest Veterinary Hospital and make arrangement for proper treatment. As he would be a trained man from the Veterinary Department, he would also be able to help the Veterinary Assistants in administering injections. The Compounder would start his service on a salary of Rs. 20 per month rising to Rs. 30 by an annual increment of Re. 1 with a permanent cycle allowance of Rs. 5 per month. The society would also keep a small stock of medicines.

In order to meet the expenses it is proposed that each member of the Society would contribute 8 annas per annum, and the Society should approach the Veterinary Department and the Etawah District Board to help with a small annual contribution or aid. It is hoped that about 500 members would join the Society the first year.

An approximate budget of the Society in the first year would be :—

RECEIPTS.	Rs.	EXPENDITURE.	Rs.
1. Contribution from members 500 at 8 annas per member	250	1. Pay of Compounder, including cycle allowance (Rs. 20+5)	300
2. Aid from the Veterinary Dept. in the first year ..	100	2. Cost of medicines ..	100
3. Aid from the Etawah District Board ..	100	3. Miscellaneous and preliminary expenses in the first year	50
Total ..	450	Total ..	450

As injection serums are supplied by the Government their cost has not been included in the above budget.

Another important matter which has to be considered is that of injections for epidemics. It is a well known fact that the Veterinary Assistants placed in charge of hospitals are already overworked and do not find time to attend all cases in times of epidemic. Sometimes the villages afflicted with epidemics are situated so far from the hospital that the

(*Continued on page 228*)

A Book Review

On the Road to Market BY EMILY GILCHRIST HATCH.—(*Printed at the London Mission Press, Nagercoil, Travancore, India.*)

If animals could only talk! And those animals who are so often treated so unkindly on the road to market in any part of India do talk in this appealing two-act drama written in the interest of kindness to animals.

One half of the drama is the familiar market-day scene. The herder beats his goats. The cow with the broken leg is left to die. The dhobi lashes his overloaded beast of burden. The bulls are cruelly choked and branded. The ducks are crowded into a tiny basket.

But unlike most market-days, the animals change places with their oppressors, and in a mysterious background of witches, man suffers the same tortures as those animals he so cruelly treats.

Man learns his lesson, and all who are served by animal life may well apply that lesson to themselves. Men must be just and kind toward animals, for "MAN and ANIMAL are on the same level."

For an outdoor performance, "On the Road to Market" would be excellent. However, because of the large number of animals required, the production would be difficult.

W. J. W.

"Education is a slowly working leaven in an immense mass whose pervasive, directive force cannot be felt generally for many years."

GENERAL ARMSTRONG.

REPORT FROM THE DEPARTMENT OF AGRICULTURE, UNITED PROVINCES

FOR JUNE, 1938

I—Season.—There was above normal and heavy rainfall in all districts of the Provinces, with the exception of some districts in Meerut Division. It was above 10 inches in 15 districts, Gonda topping the list with a record of 18·45 inches.

II—Agricultural Operations.—Agricultural operations are generally up to date, except in Meerut where they are reported to be backward for want of sufficient rain. Preparation of land for, and sowing of, *kharif* continues.

III—Standing Crops and IV—Prospects of the Harvest.—Condition of standing crops is satisfactory and prospects are favourable.

V—Damage to Crops.—No damage to crops is reported.

VI—Agricultural Stock.—The condition of agricultural stock is reported to be on the whole satisfactory. Rinderpest and foot and mouth disease have declined to some extent, but haemorrhagic septicaemia has increased as is indicated by the following figures furnished by the Director of Veterinary Services:—

Disease	May, 1938		June, 1938	
	Seizures	Deaths	Seizures	Deaths
Rinderpest ..	7,803	4,118	5,711	3,066
Foot and mouth ..	5,173	47	2,673	36
Haemorrhagic septicaemia	146	134	620	545

VII—Pasturage and Fodder.—Fodder and water are sufficient everywhere.

VIII—Trade and Prices.—Prices of the chief food grains show a slight upward tendency as will be evident from the following figures of average retail prices in rupees per maund at the end of the month as compared with those of the last month:—

			End of May, 1938	End of June, 1938
Wheat	..	..	2·716	2 721
Barley	..	..	1·894	2·385
Gram	..	..	2·294	2·312
Rice	..	..	3·891	3·972
Arhar dal	..	..	4·464	4·489

IX—Health and Labour in Rural Areas.—Agricultural and labouring classes can find sufficient employment in fields. The death roll from cholera is reported to be high during the month.

For July, 1938

I—Season

There was general, widespread and heavy rainfall all over the province in July, 1938. With the exception of 15 districts, it was above normal throughout the province. Dehra Dun, Basti and Gonda topped the list with a record of 36·27″, 23·48″ and 22·52″ respectively.

II—Agricultural Operations.—With the exception of the areas affected by floods, agricultural operations are up to date. Preparation of land for *rabi*, sowing and weeding of

kharif and transplantation of late rice continues. More rain is still needed in Mainpuri district.

III—Standing Crops and IV—Prospects of the Harvest.—Condition of standing crops is satisfactory and prospects are so far favourable.

V—Damage to Crops.—No serious damage to crops is reported, except slight damage by floods or excessive rains in lowlying lands.

VI—Agricultural Stock.—The condition of agricultural stock is reported to be satisfactory on the whole. Rinderpest and foot and mouth diseases have further declined, but mortality from haemorrhagic septicaemia has increased considerably as is indicated by the following figures furnished by the Director of Veterinary Services :—

Disease	June, 1938		July, 1938	
	Seizures	Deaths	Seizures	Deaths
Rinderpest	5,711	3,066	3,303	1,760
Foot and mouth	2,673	36	3,272	26
Haemorrhagic septicaemia ..	620	545	3,594	2,692

VII—Pasturage and Fodder.—The Deputy Commissioner, Sitapur, and Collector, Etawah, report that there is no pasturage available in their district, but there is no complaint about fodder and water scarcity.

VIII—Trade and Prices.—Prices of chief food grains, *viz.* wheat, gram and rice, have slightly risen, while those of barley and arhar have declined to some extent. The following figures compare the average retail prices in rupees per maund at the end of the month with those of the preceding month :—

	End of June, 1938.	End of July, 1938.
Wheat	2·721	2·772
Braley	2·385	2·038
Gram	2·312	2·460
Rice	3·972	4·082
Arhar dal	4·489	4·435

IX—Health and Labour in Rural Areas.—The condition of the agricultural and labouring classes is satisfactory. Sufficient employment for them is available in the fields. Cholera and small-pox is reported from a number of districts.

A SCHEME FOR A CO-OPERATIVE VETERINARY AID SOCIETY

(*Continued from page 223*)

Veterinary Assistant in charge of the hospital cannot attend them in time. Under these circumstances it is necessary that the compounder, who will be a properly trained man from the Veterinary Department and will be working under the guidance of the Veterinary Inspector and the Veterinary Assistant of the local veterinary hospital, should temporarily be allowed to handle injection serums even in the absence of the Veterinary Assistants. In order to safeguard mishandling, it may be arranged that when an epidemic breaks out the Veterinary Assistant, on receipt of information from the compounder, visit the village, ascertain the nature of the epidemic, and then order the proper injection serums. After the serum has been received, it would be handed over to the compounder who would carry out the injection under the guidance of the Veterinary Assistant. This would be one interesting scheme worth giving trial. The services of the compounder would also be utilised for castrating scrub bulls and looking after the breeding bulls that have so far been supplied, and are being supplied extensively, but go uncared for.

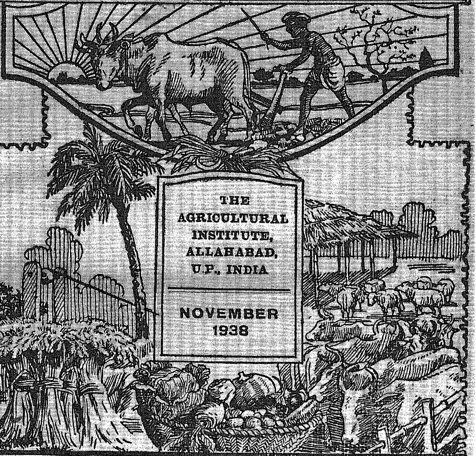
THE

ALLAHABAD FARMER

A bi-monthly Journal

OF

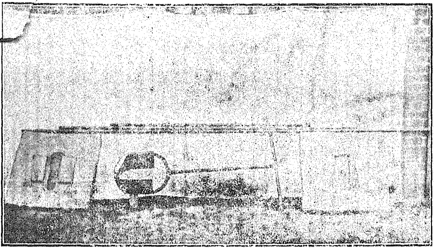
Agriculture and Rural Life



"It will not be doubted that with reference either to individual or national welfare agriculture is of primary importance."

GEORGE WASHINGTON

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility and sanitation, and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

The Allahabad Farmer

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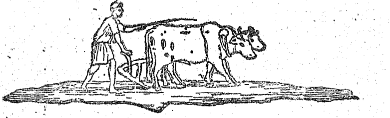

VOL. XII] NOVEMBER, 1938 [No. 6.

An Editorial

Artificial Insemination. This new technique in animal breeding is getting more and more popular in Europe as well as in America, and seems to offer great possibilities in the future especially for our country as the cost of the introduction of foreign bulls into this country is enormous. The preservation of the semen injected by the bull and inseminating a portion of it into the cow is the method which will make the purchase of foreign bulls almost unnecessary in the future.

We therefore take great pleasure in recommending to our readers the article by Mr. Devadanam published elsewhere in this issue which was written in the form of a "travelogue," but which gives a glimpse of the development of this new method in western countries and the possibilities of its being adopted commercially for the benefit of animal breeders throughout the world.

The Partabgargh Health Unit.

The Health Unit, Partabgarh, started by the Government of the United Provinces, with the assistance of the Rockefeller Foundation (U. S. A.), about five years ago, is now well known not only in this province but throughout the country. This Unit under the direction of Rai Bahadur Dr. K. P. Mathur, Director of Public Health, U. P., has made a careful study of the health needs of the villagers of the district and has evolved a very practical health programme for the rural areas. At the suggestion of this officer, Dr. K. Prasada, Medical Officer in charge of the Unit, has put out recently a book which gives a good deal of information about the scheme, about which all those who are interested in public health and rural reconstruction would like to know.

The book takes up in detail the many activities of the Unit, such as popular health education; maternity, infant and pre-school hygiene; school hygiene; control of communicable diseases; rural medical relief; registration of vital statistics; general environmental sanitation; health leagues; health unit office; and offices of the health visitors, midwives and sanitary inspectors. The book is also well supplied, with instructive illustrations. We have read the book with a great deal of interest and take great pleasure in recommending this very timely publication to all those who are interested in public health and rural reconstruction generally.

* * * *

Growing Vegetables in Water Tanks.

One of the recent developments in the scientific culture of plants is the raising of crops in shallow water tanks wherein a few handfuls of chemicals have been put in. The name given to this new science is hydroponics or the science of water culture of plants. It has been reported that in California by using this system they have been able to get as much as 2000 maunds of tomatoes per acre. Using this same process vegetables of all kinds are being grown in Wake Island, one of the islands in the Pacific, where aeroplanes have to call on their way across the ocean.

For the purpose of growing vegetables by this method one has to build a shallow tank with a wire netting on it. Mosses or shavings of rubbish are then spread on the wire netting. Water is then poured in, to which is added the necessary chemicals in required amounts. This arrangement is then ready for sowing which consists in putting the seeds on the bed of moss. If the proper chemicals are put in and in right amounts, it is said that the plants will grow profusely. However if the necessary chemicals are not there and if they are not present in the proper quantities the experiment will result in failure.

The method is however not commercially successful except under very restricted conditions. And a great deal has to be known before it may be adopted on a large scale.

* * * *

The marketing of Agricultural Produce.

The marketing of agricultural produce is a very important link between the cultivator and the consumer. Improved marketing methods help the increase in production of agricultural produce by an increased consumption.

The conference of ministers held at Delhi this month passed a resolution recommending that the marketing scheme, which was started recently in this country, should be continued. The ministers assembled in Delhi also appealed to all provinces and states to continue their co-operation in the future.

With this sentiment we heartily concur ; and we further wish to appeal to the public to help make this scheme a success. The official supervision of grading of Agricultural produce will ensure an increased faith, on the part of the public, of getting the materials one in asking for. This will ultimately result in greater consumption of goods and hence greater increase in production.

We have no doubt at all but that the system of marketing in this country needs a great deal of improvement. The improvement in this direction alone will add greatly to the welfare of the Indian cultivation.

THE PROBLEM OF AGRICULTURISTS' DEBTS IN INDIA

BY HARDEO PRASAD SRIVASTAVA,

Agricultural College, Cawnpore

"The problem of agriculturists' debts, and their redemption from the burden, is one of those pressing questions which demand the earliest possible attempts at solutions. The volume of agriculturists' debt is variously estimated at between 800 to 1,200 crores of rupees, equal to the entire year's produce of new material wealth in this country at present prices"—K. T. Shah.

Dr. W. H. Wilson, who has studied village conditions in India first hand, describes the Indian peasant as demonstrating the economics of poverty. And he is right in that. Because we being educated on Western lines think in terms of maximum production and maximum efficiency that we have little idea of a person who thinks in terms of minimum production and minimum efficiency. We are so much engrossed with this idea, that we are unaware of the fact that a greater part of the income of the Indian people is spent in paying the annual interest for their debts.

The extent of serious embarrassment through debt can be ascertained with fair accuracy from the enquiries of the committee appointed by the Government of India eight years ago to report on the subject. It appears that nine thousand millions of rupees are as debt on the peasant. And for U.P. only, it has been estimated that about 124 crores of rupees are as debt on land mortgage and about 54 crores of rupees have been given on bail from others. If the rate of interest on the previous loans is estimated at 9 per cent. per annum and on the latter at 18 per cent. per annum, the total expenses on interest come to more than 16 crores of rupees which is double the annual revenue of the province. Let us take it in another sense. The total estimated debt in U. P. is about 124 crores of rupees and the population of the province

is about 49,614,833. So of the 124 crores of rupees each man can get Rs. 25 or say in each village Rs. 11,200 may be distributed. So we can easily understand the burden of debt in the Province as well as in the country.

There is nothing strange in the fact that the farmers are in debt, neither there is anything to be afraid of. The farmers of every country are in debt. They have also to take loans. They will die of starvation, if the *mahajan* stops lending money. Because their only occupation is agriculture and agriculture is such a kind of industry in which the farmer has to bear practically all the expenses of production, before he gets anything from his crop. The farmer has to manage for the expenses not only for making his fields ready for sowing, seeds, and irrigation, but also for the maintenance of his ownself and his family till the harvesting of the crop. A labourer gets his wages after the day's labour in the evening, the men on service get their salaries at the end of the month. the shop-keeper gets something at least daily for his maintenance, but the farmer gets the remuneration for his labour after six months or sometimes after 8 or 9 months, it is possible that for some reasons he may not get sufficient yield and then he has to borrow and wait for his income till another harvest. Moreover, a man in some other industry can stop or lessen the manufacture of a commodity while a farmer cannot, nor can he begin to manufacture when the market is good.

Most of the farmers are entangled in the clutches of debt, before they start working on the field. Some take a huge sum for the payment of presents or *nazarana* as it is called, and most of them inherit their ancestral debts, the redemption of which they think their duty, because they believe that unless they pay up the debts of their ancestors they cannot get salvation! The present indebtness is in most part a legacy from forefathers. The Indian peasant is born in debt, lives in debt and dies in debt.

The greatest evil is that most of the debts are incurred for unproductive purposes. If the money is borrowed for purchasing bullocks or seeds, or for digging wells, or for irrigation purposes and such other kinds of work, in which after

investing the money, the income is so much increased that the farmer has a balance even after paying the principal and the interest, this will help in mending the fiscal condition of the farmer. But just contrary to this, the farmer, in most of the cases, borrows money to spend in marriages, dowries, or for making ornaments for the female folk. The farmers of other countries are also in debt, but the thing is that they borrow money for productive purposes and they are better off than the farmers of India.

Then the increase in population is likely to be a potent cause of debt. This is a most serious problem confronting us to-day. Agriculture is stagnant whereas mouths are increasing faster than food. The agricultural population of India alone is 192 million persons or 70·6 per cent. of the whole, and the cultivated or cropped area in British India is 261·9 million acres. This gives slightly less than one acre of cultivated land per head of the entire population of British India and 1·4 acres per head of the actual agricultural population. Of course, increase of population is a sign of well being, but it is only when production, agricultural or industrial, outstrips it.

Then the inevitable result of increase in population is the splitting of holdings. Many farmers have so very little land to farm on that it becomes very difficult for them to maintain their family even in years of good produce. An official committee appointed to investigate found that only 18 per cent. of the farmers are such who can maintain themselves both in years of good produce and scarcity, 30 per cent. are such who cannot maintain themselves even in years of good harvest and 52 per cent. are such who somehow or other manage themselves in good years but cannot maintain if the crop fails.

Bad seasons, or more accurately seasonal viccissitudes, are also the cause of indebtedness. There are not only bad seasons, but great fluctuations. The harvest has become a gamble on rain and produced gambler's habit. The holdings are so small that even a moderate harvest compels one to borrow, because rain is apt to come at a wrong time or in too great abundance and succession of harvests is none too good.

But land is dearer to the peasant proprietor than most things. It is the alpha and omega of his life and the only means of sustaining it. But owing to the increase in population and the demand for food with it, there has been competition for land, so much so that even the least fertile lands have come under cultivation. And greater intensity of demand means greater ability or willingness of the consumers to pay higher price. The price of land being abnormally high, borrowing to buy land is unprofitable and so it becomes an important factor of debt. But, it might be argued, land is sold from one to another and so a loss of one is a gain to another and therefore the result on total indebtedness should not be much. But, no, it is not the case, as the loans are not repaid as readily as they are taken.

The *mahajan* lends money to the farmers. In some cases he is the *bania* himself, in some he is the zamindar and in some cases the farmers themselves take up this business of lending money. But it has been known that the zamindars and the farmers are more exacting and exhorbitant than the ordinary *mahajan* or *sowkar* whose business it is to lend money.

The inordinately enhancing of the original debt by charges of high compound interests and constant exaction from the debtor of fresh bonds or other instruments of obligation has also been a cause of extreme indebtedness. An additional recorded cause of the general increase of debts among the ryots is security, brought about through the more active prosecution for the money-lending business by a lower class of *sowkars*. Not only this, the *mahajans* play mischief and tricks with the poor ignorant farmers. Some of their tricks may be enumerated as follows: –

1. Some of the *mahajans* charge the interest for one year at the time of advancing loan, but they do not enter this in their account books.

2. Some of the *mahajans* get the signature or thumb-impression of the borrower on blank paper and later on increase the amount

3. It is very easy for them to make 20 for 2 in their entry books

4. Some of the *mahajans* enter little amount in the receipts and some such receipts have been found with *Ram Ram* or such other things written on them. And when the borrower presents the receipt in the court, he is ashamed and has to return back to his home.

5. Most of the payments are not entered in the account books and so the register is not a record of actual facts as it should be.

6. The borrower has to give something as presents to the *mahajan*.

7. The rate for grains is decidedly very great.

There are so many other tricks and mischiefs which the *mahajans* play with the borrower. Besides the security of the ryots, person, credit, stock gnd movables, house and lands, and the joint security of a surety, the labour of the ryot is also drawn into the dealings with the *sowkar*. This form of bond is not uncommon. Sometimes the terms are that the debtor is to serve the *mahajan*, and that his wages are to be credited at the end of the year or that a certain sum is to be worked out by service to the *mahajan* for a certain period. Sometimes the wife's and children's labour is also included in the bond. Sometimes the farmer has to sell all his produce of harvest to the *mahajan* at a price less than in the market.

Moreover, the creditor often craftily allows the debtor to postpone repayment until such time as he (the creditor) can bring the arms of law to snatch away his cattle and his land from him. There are so many *mahajans* who are master in this art of increasing their lands in this unscrupulous fashion.

Then there is the ever increasing rate of interest which is responsible for the increase in debt of the farmer. In Assam the rate of interest is 12 to 75.%, in Bombay 12 to 50%. In Bengal it is charged from 37·5% to 300%, in C. P. up to 24%. In the Punjab with mortgage it is 13·5% and excluding mortgage it is 75 to 150%. In the U. P. it is generally charged at 44% and what to speak of the *Kabuli Pathan*, their rate of interest is so high that it is not possible for the debtor to pay up the interest even.

Then the price of agricultural produce has gone down since these past seven or eight years, which has made the burden of debt on the farmer so heavy that they are now practically hopeless. It has become difficult both for the farmers and the *mahajans*. The farmers cannot pay up their debts and the *mahajans* are unable to realize their dues from the farmers. So the *mahajans* have stopped lending money to the farmers.

The railways and the customs duty have also accentuated the intensity of debt on the ryots. It is only for this that the wheat imported from Australia sells cheaper in Bengal than the wheat from the Punjab.

The increase in the rate of currency is also responsible for the increase of debts of the farmers. Owing to the increase in the rate of currency the purchasing power of the farmers has been hampered, and lessened. The current ratio of the rupee to sterling is not at all sound in the present circumstances. The total depletion of sterling resources to maintain the rate of exchange has already amounted to about Rs. 35$\frac{1}{4}$ crores. It will be seen that the sterling resources at the disposal of the Reserve Bank of India are being freely utilised. The continuance of this process cannot but have a deflationary effect with all its attendant evils of monetary stringency, falling of prices and commercial and economic mal-adjustment and deterioration. So the revision and thorough examination of the currency for the interest of the country is of vital importance.

The abolition of the Panchayat system might also be a cause for the increment of debt on the farmer, because this has led to the increase in the habit of litigation which drains so much of money from the pockets of the farmers for petty matters.

Then the want of pasture lands has all the more straightened the condition of the Indian farmer.

Having thus enumerated the various causes of ryots' indebtedness, I will now briefly discuss the remedial measures.

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ed from India or say from the world, though time and education may reduce their strength. An agricultural population everywhere is comparatively ignorant, they are found so even in England, America and other western countries. But there is hope for gradual improvement in this respect through village schools. Even then comparative poverty must continue to be the lot of the peasant whose soil is poor and climate capricious.

Drastic attempt should be made to solve the problem of indebtedness of the agricultural population. A campaign of saving should be started to teach the people the good of saving and of minimising and discouraging extravagance. Most of the farmers do not know where to spend and where to save. They spend extravagantly when they are in bloom and stretch their hands before others when in slump. So, first of all, they should be taught individually and collectively the benefits and necessity of saving. It is better to save something for an evil day than to incur debt in time of depression and distress and liquidate it in time of prosperity and happiness.

On the threshing floor they should set apart say a maund or two in the name of their wife and children. If they save in cash they can deposit the sum in a saving bank of the nearest Post Office.

The central bank should organise the distribution of *hundies* to every home and open an account in the bank. Every ryot should deposit the money in *hundi* instead of spending it on drink or for any other undesirable purpose.

Then the extravagance in social functions and other undesirable activities might be checked by the formation of social welfare and better living societies. These societies should comprise at least three-fourths of the families of the village. Every member should sign a paper promising that in social or ceremonial function he should spend according to the recommendations of the Committee. And if he does not, he would pay the fine imposed by the Committee. It should be the duty of the Committee to fix the expenditure of the

members subject to the prevailing circumstances and to see whether the members abide by its orders.

Then the establishment of Gaon Panchayats can minimise the debt incurred on account of excessive litigation. The petty cases of civil, criminal or revenue nature of the village can be decided in the villages itself by these Gaon Panchayats. The villages should not be allowed to file cases in the court till they get permission from the Panchayat. If anybody does in defiance of it, the Panchayat should punish him. There should be a fixed day in the week to hear these cases and the judges should be honest and impartial and not persons of unsound mind. However, my subject here is not to chalk out a scheme of the regulation, functions or obligations of the Panchayat.

Provisions for easy loans for current farm operations through co-operative credit societies, in order to enable the cultivator to procure good seed and manure and make his field yield better profits, should be made. Capital for permanent improvement of agricultural land should be provided through Land Mortgage Banks. A suitable country-side banking organisation for rural credit should be a desideratum.

Then some legislative measures should be undertaken to reduce debt by providing for a reduction of the creditor's claim by compromise. But before embarking on a definite course we should weigh the issues with all gravity. The precise measure to be adopted in each province should be investigated by a committee of experts in agricultural finance in the first instance, before formulating any final proposals for practical action. Care should be taken that the credit of the cultivator is not injured in any way.

The cultivators may be classed as those (1) who are free from debt, (2) who have completely lost their lands, and (3) who have mortgaged their rights.

As regards the cultivators of the first class, we have nothing to bother our heads for, because they are the luckiest ones being free from debt.

One practical method of dealing with the cultivators of the second class is to record the money-lenders for what they

are, namely, the owners of land which has passed away from the tenants and to protect the latter from rack renting by a suitable tenancy act. There is universal agreement that the expropriated owner has sunk to the condition of mere serf, tilling the land and making over the produce to the owner. In good years he has nothing to hope for except a bare subsistence and in bad years he falls back on public charity.

In regard to the cultivators of the second class who are as yet the owners of their holdings and in respect of whom the money-lender is still merely a mortgage, the situation is different. The problem is how to preserve to the ryots their rights in their holidings which are fast slipping from their grasp.

The following measures might be proposed for the amelioration of the debts of the cultivators:—

1. The disallowance of obligation of any person to discharge ancestral debts, unless such person expressed his readiness to accept responsibility for such debts in the presence of the court.

2. The disallowance of compound interest included in any claim as well as all interests in excess of a sum equal to the principal represented in such case.

3. Legislation with the object of restricting the transferability or sale of any land should be undertaken. This habit of the cultivator should be prevented unless the land has been specially pledged as security for the debt. But at the same time the contract should be made in writing and this written instrument should be duly registered in court.

But side by side with it we have to maintain our relations with the *mahajan* also. The problem before us is how to keep the money-lender in his place, to encourage and support him in all useful functions, but to restrain him from becoming oppressor and enemy of the poor. The leading principle should be to give fair play to both the parties instead of setting by ears. We should try to diminish the risks of fraud in borrowing and extortion in repaying, to diminish the risk of loss in lending and excessive delay in recovery.

There should be interposed friendly conciliation between disputants, previous to going to the court.

In order to bring this principle into execution the following measures might be adopted.

1. The accounts between the debtor and the creditor should be investigated and a fair sum should be fixed to be paid by the former to the latter in liquidation of debt.

2. The average produce of holding should be ascertained and its money value expressed in terms of cash.

3. The surplus produce, after providing for subsistence of the cultivator and his family and the necessities of cultivation should be appropriated to the payment of debt.

4. Legislative measure should be undertaken to limit the power of incurring fresh debts of the cultivator.

Then improvement should be brought about in the present system of land records. There should be a better land recording staff.

Accurate mapping and registration of every plot contained in the field should be done. There should be proper registration in village records of all particulars regarding ownership, encumbrances and cultivating rights.

These are some of the problems and remedial measures of the agriculturists debts which I have tried to deal with. This problem is very intricate and has engaged the attention of all sections of people. What we have to do is to tighten our belt and try to better our position by bringing these measures into execution with a cool head, and relax no effort unless a successful solution of the problem has been worked out.

"I would that the rural youth of to-day could see agriculture as the great preserver of culture, and the earth as the mother of mankind"

OLIVER EDWIN BAKER.

MY IMPRESSIONS OF AGRICULTURAL INSTITUTIONS IN EUROPE

By K. Joseph Devadanam,

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When I met Dr. Higginbottom at New York City I had the opportunity of telling him of my plans in regard to a tour that I proposed to make in Europe. He advised me to write an article to The Allahabad Farmer inasmuch as he had been asked by the Editor to write one with reference to his recent trip in Europe and his impressions of the agricultural institutions. That is the reason that I am availing myself of the opportunity of giving my impres sions of Agricultural and Animal Husbandry work that is being carried on in England and Scotland, Norway, Sweden, Denmark and Germany. It is indeed presumptuous of me to embark upon such a stupendous subject as one who had only limited time to go through these countries. It would be undoubtedly a difficult task to get a comprehensive idea of the work in any one of the countries mentioned above.

My first visit was to Cambridge University, College of Agriculture. Some of my professors at the University of Minnesota were kind enough to write to the authorities of agricultural colleges in Europe in regard to my arrival at the above mentioned countries. Hence my way was paved to get to these various persons. The first person that I called on at Cambridge University was Dr. Walton. Dr. Walton invited me to his home which provided me an opportunity to look into an English professor's home, and also, furnished a place of quietness to discuss some of the important problems of the Animal Industry. At the out-set Dr. Walton expressed his regret at the absence of Dr. Hammond, who was taken to New Zealand on a special trip to advise the Government Agricultural Department in the matter of animal industry. In the Department of Animal Husbandry at Cambridge under the leadership of Dr. Hammond, and his

associates, Dr. Walton and Dr.Marshall, considerable work in Animal Breeding and physiology of reproduction and the Artificial Insemination, is being carried on. Inasmuch as Dr. Walton is interested in the work in Artificial Insemination he expressed his wish that this method of impregnation of farm animals be carried in India, and thus economise the Animal Breeding programme. For instance, with the aid of one pure-bred sire and with one injeculation through artificial method of Insemination more than half a dozen cows could be impregnated. Dr. Walton, therefore, felt that this method when utilized throughout the country, several villages which are suffering the chronic poverty, and the farmers who are financially unable to purchase desirable bulls, could be greatly benefited in their cattle breeding programme.

Unfortunately some of the Assistants in the department of Animal Husbandry at Cambridge University were out on that day, and therefore I was not able to see much of the experimental work. However, Dr. Walton was kind enough to show me some of the instruments that are used in the research of Artificial Insemination.

The country-side of England is one of beauty and a veritable garden indeed with rich grasses. Here and there one sees the British breeds of cattle grazing in these rich pastures, and it seemed to me that Great Britain is a rich pastural country rather than a country which is noted for grain farming. So my apraisal of the country is that it is not one of the rich agricultural countries, but is meant for animal grazing.

My trip to Edinburgh, Scotland, is of interest in that I had the privilege of meeting two of the great men in Animal Genetics at the Institute of Animal Genetics. Dr. Crew who is the Head of the Institute, was not available for conference, but his Assistant Dr. Bechensmith gave me sufficient time to explain their programme of Animal Breeding. Inasmuch as the cattle sheds were 12 miles away from the University premises, it was impossible for me to get there for I had only a day at my disposal at Edinburgh. The same night I left for Ayre, Scotland, where Dr. Norman

C. Wright is the Director of the Hanna Dairy Institute. Hanna Dairy Institute is three miles away from Ayre which was given by a rich farmer named Hannah, and a fund was endowed with which Ayrshire breed might be experimented upon. Subsequently, the Government of Scotland graciously granted a subsidy through additional funds which made it possible for the institute to employ Dr. Norman C. Wright, as the Director of the institute to carry on some scientific work in Animal Feeding, Breeding and Management. This institute is provided with well trained men in Animal Industry and consequently the research work is one of great importance to the country and the British Isles and the Empire at large.

Mr. Fuller, who is the Assistant Director took me through the grounds and showed me the cattle, which were on feeding trials as well as the cattle which were subject to their breeding programme, after which I had conference with Dr. N. C. Wright. He was very enthusiastic about the work in India since his memory of India and her needs were fresh in his mind. Dr. Schneider on his way to India visited Hanna Dairy Institute, Cambridge University Agricultural College and Edinburgh University Agricultural College. Therefore in all these places, the Allahabad Agricultural Institute was not a new reference, but one that had been known for sometime. Especially Dr. Wright was interested in the Agricultural Institute at Allahabad, and talked in glowing terms about the work that is being carried on here, but his advice was an urgent need for scientific study of all the methods that are being carried by the indigenous *gwalas*, seemed to him were of more importance than the adaptation of expensive investigations on the Western basis which are not fundamental to the village life. Of course, he was interested in the Breeding Problem in India, but his word of wisdom was to have no wholesale cross-breeding programme, but improve the indigenous breeds by careful selection. In regard to the Artificial Insemination work in India he felt it was not one of great importance at present.

I had a very delightful voyage across the North Sea and landed at Bergen, Norway. I hastened from Bergen

to Oslo which is over 300 miles, going through very beautiful mountains and many a scenery. Upon my arrival at Olso I paid a visit to the University at Oslo, and secured sufficient information in regard to the agricultural colleges in the country. I was graciously assisted to find the various Heads of the Departments of Animal Husbandry and Veterinary Sciences at Oslo proper. The Veterinary Department is carrying on some scientific research work on the physiology of reproduction, but they do not have any programme in animal breeding work there. However, at As, Norway, where the National Agricultural Colleg · is located, considerable research work is being carried on in animal breeding with special reference to Swine Breeding and Dairy Cattle Breeding. Dr. Berge, the Principal of the National Agricultural College took me round and showed me the cattle and the swine and the grass land plots He further invited me to stay in the Hostel with the boys to know something intimately in regard to the life of the student body there and their extra curricular activities. I was very much impressed with the provision they made for a practical Agricultural Training for the youth of that country.

My next visit was to Sweden. At Stockholm there is no Agricultural College, but 20 miles from there is the Swedish National Animal Breeding Institute where under the guidance of well trained men remarkable work in animal breeding is carried on. Under the leadership of Dr. Backstrom, Artifical Insemination work on dairy cattle, horses, swine, and poultry is being carried on. The Institute also has inaugurated a plan which is significant in that it has a wider scope of service to the neighbouring farmers in the country with their co-operative methods of animal breeding. Inasmuch as I stayed there for two days, it had been my privilege to go with Dr. Backstrom and collect semen and then go out with him into the country at two different times during the day to artifically inseminate the cows, which were in heat. The semen that we took in the morning was used on these two cows, which were located in two different places. Dr. Backstrom told me that at times during the right season it was possible to inseminate 20 cows with one ejeculation. Thus the

possibilities in Artificial Insemination work came to me in a very vivid fashion when I saw this great work in its full swing.

Then I went to Upala, where the Swedish National Agricultural College is situated. Here again sufficient money has been subsidized by the Government in order to carry on in Agricultural Experimentations. Therefore, like State Universities in America, this Agricultural College, is richly endowed with money and men to carry on the desirable work. I have seen their herd of cattle, swine, and poultry, but no work is being done in the field of Artificial Insemination. However, they are following scientific methodology in their Animal Breeding Programme.

Copenhagen, Denmark, was a great fascination to me because of the incessant talk on Co-operative Movements in Denmark. However, I had letters of introduction to Professors Larsen and Johnsen, the Royal Agricultural College of the University of Denmark. Unfortunately these two gentlemen went away that day and therefore the Assistant took me round and finally I was introduced to Prof. Dr. Edwards Sarnsen who is carrying on work in Artificial Insemination. He showed me the movie picture in regard to his work in three different reels where the farmers came together in Co-operative Animal Breeding Project and Prof. Sarnsen serves them in an advisory capacity representing the University of Denmark. He was kind enough to show me all the instruments and I was very much interested with the new techniques that have been developed at Denmark in Artificial Insemination. Prof. Sarnsen, further, elucidated his work in interpreting to me the difference in Artificial Inseminaiion work and Natural Breeding. The difference between the Natural Breeding and Artificial impregnation was about 10 per cent and that is in favour of Artificial breeding.

Kiel is situated on the North-West of Germany which serves as a strategic naval point of the northern boundary of Germany. Here in 1922 an Institute was inaugurated for Animal Production and products which today is one of the outstanding institutions of its kind. Prof. Macy of Minnesota University urged me to visit this place. So, after a night's

sleep in the train from Copenhagen, I arrived at Kiel. Inasmuch as I was interested in the production side of the enterprize I made my way to that department. Director Prof. Dr. Bunger graciously received me and gave me an audience through an interpreter. Prof. Bunger explained to me some of the experimental work that was being carried there at that Institute in Animal Breeding and also in Mastitis and on Milk Yield, and also on the Breeding Programme. Furthermore, the authorities of the Institute favoured me with a movie picture giving a sequential development of the Mastitis and its diagnoses and remedy. In as much as Dr. Schneider had informed me in regard to some of the breeding problems in our herd at the Institute, with the little knowledge that I had of the herd I talked with most of these men, but I was not able to get any satisfactory suggestion from them owing to the fact that I was not well acquainted with sufficient information in reference to the herd and they could not apprehend the hazard such as the climatic and nutrition problems that we have in our country. Hence I was rather unfortunate to get any expert advice from them but was fortunate to see some of their work and was greatly impressed. Unlike Norway, Sweden, and Denmark, Germany is a huge country with conspicuous evidence of agricultural possibilities.

I left Berlin for Trieste, Italy, and took my steamer for India, and am now busily engaged in my programme of work at the Allahabad Agricultural Institute.

"I have a Baylife as skilfull as may be; yet remembering the old saying that the best doung for the fields is the master's foot and the best provender for the horse the master's eye, I play the overseer myself."

GERVASE MARKHAM (1620).

"Educate the whole man is the idea, fit the pupil for the life he is likely to lead."

GENERAL ARMSTRONG.

WIH GUERNSEYS IN INDIA*

By B. H. Schneider†

Numerous attempts have been made in India to combine the milk yield of Western dairy cattle with the hardiness and suitability to local conditions of Indian breeds

Indian cattle have been subjected to countless generations of rigorous natural selection for ability to withstand singularly hard conditions, and no one would dispute the view that for hardiness, vigor, size, conformation, and suitability for draft purposes, the desired type can best be obtained by selection within the indigenous breeds. The principal character of value under Indian conditions which Western breeds excel the indigenous cattle is milk yield.

The use of a bull from Western breeds, such as Guernseys, Holsteins, Jerseys and Ayrshires, has been questioned during recent years. However, at the Allahabad Agricultural Institute of the Allahabad Christian College, they feel that the Western breeds may be of considerable value to India if properly used. Most of the Government officials condemn foreign breeds without considering what those breeds have to offer when crossed with Indian cattle.

European breeds imported into the United States have rendered a great service. The problem is not so simple in India for here cattle live under very severe tropical conditions in the midst of all kinds of infections and diseases. Only those cattle that have been able to withstand these conditions have lived through the centuries in this section.

There are probably some individual Guernsey or Holstein animals that have greater resistance than others, for these have been used at the college and are giving results.

The Guernsey bull, Hopeful's Marmion of Liseter Farm 112194, was placed in service and proved to be a very good

(*) A reprint from the Guernsey Breeders' Journal, August 15, 1938.

(†) Head of the Dept. of Animal Husbandry, Allahabad Agricultural Institute.

bull but, unfortunately, did not survive the climate. Two of his daughters showed increased production over their dams from less than 2,400 pounds of milk per lactation to over 6,000 pounds of milk.

The bull given to the college by George Ferguson of Oxford, Pennsylvania, is now in the herd of the Leper Hospital. From appearances, his daughters are proving to be very good cows.

This department is supervising the breeding work of three institutions: Our own Institute, the Naini Leper Hospital, and the Central Prison, Naini. We feel that if we are to make any considerable impression on the cattle of this area, we must have all of these institutions breeding good herds along parallel lines and supplying bulls for miles around us to all small breeders who desire to improve their stock. Therefore, we are interested in the herds of these other two institutions as well as our own herd.

After making the first cross of a foreign bull to Indian cows there are three courses of action open. The first is to continue to grade to bulls of that foreign breed. The second is to inter-breed the first generation of cross-bred animals and the third is to backcross these cross-bred heifers to the best Indian bulls available (bulls of the same breed as the dams of the cross-bred heifers).

Inter-breeding cross-breds is not to be advocated. While an animal breeder desires a certain amount of variation so that he may select the more desirable types and better producers, he does not want such extreme variations as occur in the second generation when two cross-breds are bred together. Very asymmetrical types result (even with Guernsey Cross-breds as we may point to one or two animals, as examples, in our own herd) and some of the most off-type animals I have ever seen come out of such second generation individuals. Hybrid vigor, which is noted in the first generation, is entirely lost thereafter.

We have undertaken to follow the third alternative given above, namely, to backcross our first-cross heifers to bulls of the best Indian breeding that we can find. Our foundation

cows are of the Sindhi breed, one of the better Indian dairy breeds. The best cow which we have had to date of the Sindhi breed, produced 8092 pounds of milk and 394·4 pounds of butter fat in 365 days. Unfortunately, they are not all that good. She is the best that we have had and most other dairy farms have not had animals greatly superior to her.

At the Imperial Agricultural Research Institute, New Delhi, the two best cows have produced over 10,000 pounds of milk in ten-month lactations under as ideal conditions as possible to have in this country. They were milked four times daily and fed as we would feed cows for the Advanced Register. Their only limitation, as far as environment is concerned, is the high temperature of Indian summers. I am not certain that Indian cattle have in them the potential ability to be improved to the level of production of the best of our breeds of European origin. Many people in this country are talking of improving Indian cattle by selection, but I have maintained that *it is necessary to have the thing desired in order to select it.* I am not certain that Indian cattle have in their germ-plasm the genes necessary for high production, if they are to be bred to produce milk yields equal to those of our best Guernsey cows in the United States.

If the genes for high milk production are not present in the Indian breeds, they must be put there. Indian cattle have certain qualities which must be preserved if the anima's are to survive the climate of this country. Too high a percentage of foregin breeding may be undesirable. Therefore, we are back-crossing to good Indian bulls We hope by one outcross to a foreign bull to introduce some of the desired factors for high milk production. A cross-bred animal is profitable. Quarter-bred Guernsey cows may average somewhat lower in milk production than half-bred cows, but that is the best that we can do. In fact, if we establish a true-breeding strain having a definite percentage of Guernsey (or other European breed), I feel at present that that percentage should not be more than twenty-five and probably less.

Because we make only one out-cross to a Guernsey bull or bull of any European breed, it does not mean that this is

unimportant. If we, so to speak, give only one shot of such superior foreign blood, it is important that one shot be of the very best. We are depending on the quality of the bull in that one out-cross to introduce genes for high milk production.

The system for putting bulls into villages is an interesting one. The college is naturally anxious to have the breeders use better bulls. There are too many cattle in India and the great excess is made of scrubs which tends to make a rather low average price for dairy cattle and a relatively high price for feed.

With each mature bull that is placed in a village, the college gives a bull calf that is to be raised and used when becoming of servicable age. When the bull calf is full-grown and the daughters of the first bull are ready to be served, the older bull is taken back from the village and given to a second village and another bull calf given to the village. In this way provision is made for the breeding of two generations and no bull is bred to his own daughters. When the poor village breeder has the service of the mature bull, he is willing to take a bull calf to rear.

To stimulate interest in cattle breeding and to help these poor milk producers in this area, we are assisting in marketing their milk. The Indian milk producer is traditionally addicted to the adulteration of milk. Many of them consider twenty per cent water in the milk as quite honest. Beyond this amount, dilution might be looked upon as a dishonest practice. We have, therefore, established what we term "milking stations" where eighty or ninety men living within a radius of a mile or two may bring their cows to be milked under our supervision. The milk of each individual cow is weighed, so the milking station has this additional advantage of obtaining records on each individual villager's cows under village conditions as well as to prevent adulteration. Further, our system of milking stations has another advantage that a bull placed at one of them has a maximum opportunity to breed, as all cows brought there are usually fresh and hence open to service. These milking stations seem to have fulfilled a very real need in this area, and as soon as we are financially able, we hope to expand them.

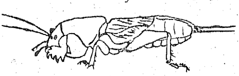
MOLE CRICKET

Its danger and control at Allahabad

By W. K. Wesley, M.Sc., L.T.,

Professor of Entomology, Allahabad Agricultural Institute.

The Mole Cricket (*Gryllotalpa Africana*) causes injuries to the plants by chewing the stems and roots. For chewing insects stomach poisons are used. These poisons act when they are taken into the alimentary canal Poison Bran Mash has proved very successful in controlling the crickets. The poison is broadcast over the infected fields



in the evening by shaking it out of a sack. The amount of bait required for an acre is 4 to 22 seers, depending upon whether the attack is light or severe.

Field formula for poison bran mash.

1.	Paris green	...	½ seer.
2.	Bran ...	...	25 seers.
3.	*Gur* or molasses	...	½ seer.
4.	Water ...	...	2 gallons or 9 seers.

Method.—Dissolve the half a seer of *gur* or mix the half seer of molasses in water and use this solution to moisten the 25 seers of bran. Bran mash should be just damp but not wet and soggy. Work up Paris green in this mixture thoroughly by stirring well. Add the juice of a dozen limes to improve the efficiency of the bait. Place the mixture in a sack with a long tube tied to its mouth. The bait is ready for use now.

Modification.—Paris green can be replaced by lead arsenate at the rate of three quarters of a seer of lead arsenate

paste to every half a seer of paris green, given in the formula. Mulberry leaves or sawdust can be substituted for bran.

Precaution.—Care should be taken to keep away human beings, domestic animals and poultry from eating this very poisonous substance.

Other Insects.—Poison bran mash is proved very effective against cutworms, grasshoppers and locusts also. It can be used against these insects in the same way as for the crickets. For the house crickets, the bait can be placed in small receptacles in safe places.

Labour is one of the great elements of society—the great substantial interest on which we all stand. Not feudal service, or predial toil, or the irksome drudgery by one race of mankind subjected, on account of their colour, to another ; but labour, intelligent, manly, independent, thinking and acting for itself, earning its own wages, accumulating those wages into capital, educating childhood, maintaining worship, claiming the right of the elective franchise, and helping to uphold the great fabric of the State—that is American labour ; and all my sympathies are with it, and my voice, till I am dumb, will be for it.

It is to labour and to labour only, that man owes everything of changeable value. Labour is the talisman that has raised him from the condition of the savage; that has changed the desert and forest into cultivated fields; that has covered the earth with cities, and the ocean with ships; that has given us plenty, comfort and elegance, instead of want, misery and barbarism.

Miserable is he who slumbers on in idleness. There is no rest from labour on earth. Man is born to work, and he must work while it is day. Said a great worker, "Have I not eternity to rest in ?"

TOMATO AND ITS USES

By S. R. Swarup,

Agricultural Institute, Rajshahi (Bengal).

Tomato, on account of its nutritive value and vitamin contents has been highly spoken of, all over the world, as a very good human food. They are full of rich salts—phosphates, iodine, magnesia, sulphur, iron and calcium. Tomatoes are rich in vitamins A, B, C, and according to some authorities in vitamin D too. They contain twice as much iron as milk and more than apples, oranges, onions and most other vegetables.

The tomato is a native of South America and came to Europe after the discovery of America. Italians appear to have been the first to use the tomato for food, being followed by the French and then the English. Its cultivation, unlike many other winter vegetables is quite easy. An average quality soil with some moisture and organ c food will grow quite a good crop of tomatoes, yielding up to 5,000 lbs. of ripe tomatoes per acre. The sowing time is from July to October, and the fruits are available from December onwards up to April. During January and February, the markets are glutted and hence the grower gets a very low price.

It is at this time that there arises a need for utilising tomatoes for manufacturing some of its products for use during later months. Among these may be mentioned tomato ketchups, tomato jams and jellies, tomato cocktails etc., which may be made at home for the family's use throughout the year. Commercially the ripe tomatoes can also be canned; tomato soup may be prepared and canned and tomato puree can also be made and canned. For the benefit of those who may attempt to make them at their homes, a few formulae which have proved good are given below. Domestic cooking utensils of aluminium and a family balance and a few screw-capped jars are all that is necessary for the purpose.

Tomato Jam—Take 4 lbs. of ripe tomatoes, remove all blemished and bruised portions, stalk and wash thoroughly in cold water preferably under a running tap. Put them in a clean pan and crush the tomatoes so that the juice comes out, and allow it to boil for about half an hour. Add 4 lbs. of white cane sugar, stir and boil quickly till flakes appear. Juice of four to six lemons may be added if necessary. Cool the contents of the pan slightly and then put in jars, cover with wax circles while hot and screw the caps when cold. It shall give about 5 lbs. of jam.

Tomato Jelly—

4 lbs. of tomatoes.

$\frac{1}{2}$ pint water.

4 lbs. sugar.

6 lemons.

Treat the tomatoes as above and add $\frac{1}{2}$ pint water, simmer gently for about an hour. Strain the juice well through a jelly bag or flannel and keep it overnight so that clear juice may be extracted. Add sugar while the juice is boiling and skim frequently. Add juice of 6 lemons or 10 grams of Tartaric Acid and boil briskly till the flakes appear. Fill and pack as for jams.

Tomato Ketchup.—

12 lbs. tomatoes.	$\frac{1}{4}$ oz. cloves.
$1\frac{1}{4}$ lbs. sugar.	$\frac{1}{4}$ oz. black pepper.
$1\frac{1}{4}$ oz. salt.	$\frac{1}{4}$ oz. cinnamon bark.
1 pint vinegar.	$\frac{1}{4}$ oz. paprika pepper.
2 ozs. Tarragon vinegar.	Pinch cayenne paper.
	2 peeled onions.

Select fully ripe tomatoes, remove all blemished or diseased portions and stalk. Wash them thoroughly and place

them in boiling water for 2—3 minutes. Rub them through a fine seive till the pulp is separated from the skin. Tie the spices, onion, salt and sugar in a piece of cloth and immerse it in the pulp. Put the pulp on good fire and allow it to concentrate till it is fairly thick. Then add Brown and Tarragon vinegar, bring to boil quickly and remove when of the right consistency. Bottle it immediately and cork tightly. Sterilise for 30 minutes in water at 160° F. temperature.

Tomato Cocktail—After washing the tomatoes, they may be crushed and strained through muslin. To every one lb of juice, add a chopped onion, bay leaf, 4 oz. sugar, pinch of parsley or mint and two tablespoonfuls of Worcester sauce. Let it stand for one hour and then strain. Heat it to a temperature of 180° F and bottle while hot. Sterilise the bottles for 30 minutes in water at a temperature of 175° F. The cocktail should be served very cold.

The pernicious, deliberating tendencies of bodily pleasure need to be counteracted by the invigorating exercises of bodily labour; whereas, bodily labour without bodily pleasure converts the body into a mere machine, and brutifies the soul.

Whatever there is of greatness in the United States, or indeed in any other country, is due to labour. The labourer is the author of all greatness and wealth. Without labour there would be no Government, and no leading class, and nothing to preserve.

Honourable industry always travels the same road with enjoyment and duty, and progress is altogether impossible without it.

Do you know that one village in Northern China has specialized for 120 years in the business of hatching chicks artificially in earthenware jars ?

JUTE (Corchorus spp.)

By C. R. Banerjee,

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Commercial and local names :—The English name of this fibre is jute or Jew's mallow, and the vernacular names are *Pat, Kosta, Nalita, Meethapat, Teetapat* and *Morapat.*

In the trade, *C. capsularis* is usually known as white jute ; while *C. olitorious* is described as *Bogi, Tosha* or *Deshi.*

History. – In the early part of the 19th century jute fibre was mainly used for the making of homespun cloth by the poorer classes for their own consumption. No really serious export was started until the year 1838 when the flask spinners of Dundee began to realise the value of jute as a fibre. The trade remained the monopoly of Dundee until the year 1858 when the first jute mill was established in Bengal. Jute fibre is needed in almost all kinds of trades of the world. The gunny bags are used by most of the countries to export their goods in, though they have been replaced to some extent by various jute substitutes in Russia, Germany and France ; by cotton in United States, America ; by containers made of straw in Japan, and by paper bags in U.S.A. and Australia. This important crop is grown mainly in India and mostly in Bengal. The following tables are taken from "Industrial Fibres", Imperial Economic Committee, London, 1937, to show the position of jute cultivation in India compared with other countries of the world.

Table I

Area (in acres) under jute in India and foreign countries:

Countries	1929	1930	1931	1932	1933	1934	1935	1936
India	3415000	3492000	1862000	2143000	2517000	2670000	2181000	282200
Formosa	6000	6000	6000	6000	7000	12000	17000	..
Japan	1000	1000	1000	1000	1000	2000	2000	(b)
Indo-China	2000	1000	1000	(a)	1000	1000	(b)	..
Total	3424000	3500000	1870000	2150000	2526000	2685000	2201000	2842000

(*a*) Less than 500 acres.

(*b*) Not yet available : assumed same as previous year for total.

Table II

Production (in tons) of jute in India and foreign countries:

Countries	1929	1930	1931	1932	1933	1934	1935	1936
India	1846000	2001000	990000	1263000	1426000	1518000	1293000	1560000
Nepal (b)	11000	12000	11000	9000	10000	10000	14000	10000
China (c)	7000	7000	9000	7000	5000	3000	4000	7000
Formosa	4000	4000	4000	5000	5000	9000	12000	(e)
Japan	1000	1000	1000	1000	1000	1000	1000	(e)
Indo-China	1000	(d)	(d)	(d)	(d)	(d)	(d)	(e)
Manchukuo (e)	(f)	(f)	(f)	1000	2000	3000	3000	2000
Total	1870000	2025000	1015000	1286000	1449000	1544000	1327000	1592000

(*b*) No estimate of area or yield is available; figures given in the table represent exports from Nepal into India.

(*c*) Exports only.

(*d*) Less than 500 tons.

(*e*) Not available; assumed same as previous year for total.

(*f*) Included with Chinese exports until June 1931.

The tables above show that jute is virtually a monopoly crop of India. Attempts have been made from time to time to introduce jute cultivation in other sub-tropical countries. The Brazil and Palestine soils and climates though somewhat similar to Bengal, yet they could not produce jute. The Governments of Turkey and the Netherlands' East Indies have taken measures to encourage jute growing in suitable areas. Jute is cultivated in Bengal, Bihar, Assam and Orissa, but Bengal alone produces 87 per cent. of the total output of India.

Area.—The areas under jute crop in the years 1936-37 and 1937-38 are 2,885,750 and 2,861,200 acres respectively. The yields are 9,635,900 and 8,617,700 bales respectively. The table below shows the position of four provinces as regards the area of jute cultivated and its yields in the years 1936-37 and 1937-38:

Table III

Areas under jute in different provinces of India and their yields

Provinces.	1936 - 37		1937—38	
	Area in acres.	Yield in bales of 400 lbs. each.	Area in acres.	Yield in bales of 400 lbs. each.
Bengal ..	2,251,150	8,035,900	2,203,200	7,071,600
Bihar ..	463,600	1,109,500	445,000	921 400
Assam ..	137,500	461,700	197,700	592,800
Orissa ..	13,500	15,300	28,800	31,900

The above table is taken from the "Ananda Bazar Patrika". a daily newspaper of Calcutta, of 17th September, 1937. The 1957-38 table is from the Government final forecast of jute which appeared in the above paper.

Botanical description.—Jute belongs to the family of Tiliaceae. It is generally a herb. The stems are solid. It is more or less non-branching. Leaves are simple, alternate and petiolate. There are two stipules at the base of the petiole. It grows up to 10 or 12 feet in height. The stem colour varies from dark green, light green to red depending on the varieties. This colour change is also found in the veins of leaves.

The inflorescence is racemose, and flowers arise from the axis of the leaves. Generally one to three flowers are found in each axis.

Jute belongs to the genus *Corchorus*. The four common species of jute, all of which may be found in the wild state in India even in localities where jute is not cultivated, are :—

(1) *Corchorus olitorius* : It has long cylindrical pod and black seeds. The leaves have no bitter taste; so it is called *Meethapat* (Sweet jute).

(2) *Corchorus capsularis* : It has round capsuled pod and brown seeds. The leaves have bitter taste, and that is why it is call *Teetapat* (Bitter jute).

(3) *Corchorus acutangulis* : It has short and winged pot It is rarely cultivated.

(4) *Corchorus antichorus* : It is called 'bil nalita'. It is wild and never cultivated.

Varieties.—In the year 1906 Mr. R. S. Finlow, with the help of Mr. I. H. Barkill, a member of the sub-committee of the Board of Scientific Advice, started a series of investigations with the object of improving the jute crop. The collection of races of jute made by the sub-committee was available, but it was very much enlarged by a careful survey of the whole of the jute growing area. All the races of both

C. capsularis and *C. olitorius* were classified in regard to their cultural characteristics of colour, earliness or lateness, tallness or shortness, and also in regard to the microscopic and chemical properties of their respective fibres. In this way was commenced the study of 'pure lines' *i. e.*, the progenies of single plants. It was ascertained by cross-fertilization experiments that the danger of contamination of pure strains by chance fertilization is small. He worked for this in the Dacca Government Agricultural Research station of Bengal. As a result of this work the following varieties have been found out :-

C. capsularis group :

(1) *Kakya Bombai* :—It is one of the best selections of jute. It is now cultivated over about 200,000 acres in Bengal, Bihar, Assam and Orissa. Kakya Bombai was the first of the pure strains to be produced and distributed in quantity. Experiments have shown that it gives three maunds more of jute per acre on the average than the local races. It matures later than any other known race and so it is correspondingly less likely to flower prematurely in a drought condition and as a result of damage by hail. It produces very white fibre. The plant is light green in colour.

(2) *R.* 85 :- It is a selection from the varieties collected from the interior of Bengal and is the progeny of a single plant. It grows very well and its yield is almost the same as Kakya Bombai.

(3) *D.* 154:—It is a selection from the varieties collected from the interior of Bengal and is a progeny of a single plant. This variety is nearly free from the disease 'chlorosis' which means yellowing of leaves. It is the highest yielding, and is better in quality than Kakya Bombai; but as it is new it has not yet gained much popularity. This is a white jute.

C. olitorius group :

Chinsura green :—It is a progeny of a single plant. It is a green race of *C. olitorius* with the remarkable heavy yielding capacity which has exhibited itself at all places

where it has been tried. It is grown on high lands of west Bengal because it cannot stand water like the *C. capsularis* varieties. In the field it does not grow much taller than other kinds but the plant contains a considerably higher percentage of fibre, and its better yields are largely due to this.

The crossing of *C. capsularis* and *C. olitorius* gives seed, but it does not germinate; so there is no way of combining the characters exhibited in the two groups.

Besides the above mentioned improved varieties there are some local varieties which are also cultivated largely. They are :—

(1) Deswal :—This jute is very early, short and much branched It has very white fibre. It is a Serajganj local variety and is not high yielding. It is sown in Dearh lands and is cut as the water rises. It is a race of *C. capsularis.*

(2) Red stemmed varieties of *C. capsularis* known by various names *e.g.*, Vidyasunder and Kajla which produce yellowish or brownish fibre, which, therefore, though as strong as the other varieties, fetch a little lower price. Kajla is liked by the cultivators because it can stand water better than all other varieties.

Ecological factors :—With the exception of rocky, laterite and poor sandy soils, all other soils are adapted for jute cultivation. The soils must be of good depth and quality. The best fibre is obtained on loamy soils. The clay soil gives the heaviest yield but the plants do not ret uniformly and sandy soil produces coarse fibre. Generally speaking a fairly fine tilth is required for jute cultivation. The coarse varieties grow luxuriantly in low-lying lands but the quality is poor. A land with a pH value above 7 does not injuriously affect *C. olitorius* though it is not quite suitable for *C. capsularis.*

A rainfall of about 60 inches a year of which about 10 inches occurs during the months of March, April and May is required. It is a *kharif* (rainy season) crop and grows well where the temperature is from 85° to 95° and

the humidity is high. A warm damp climate and yet not too incessant rainfall are the essential conditions of success of this crop. *C. capsularis* can grow under water of 5′ to 6′ high in the latter part of its growth, but *C. olitorius* cannot stand water. So the latter has to be sown on high lands. *C. capsularis* prefers a lighter kind of soil than *C. olitorius.*

Manure :—The land which receives an annual deposit of silt does not require any manuring, but the land which is not innundated every year should be manured. Farm yard manure is the best manure for this purpose: 150 maunds of farm yard manure per acre may be applied where necessary. Jute also requires a considerable amount of potash and this can be effected by applying water-hyacinth either in a rotted state or as ash. In red acid tracts lime is beneficial to apply. The application of potash controls some of the common fungous diseases with which the plant is attacked.

Cultural methods:—In low lands preparation ought to begin in November and December though usually the winter cultivation is neglected and the first ploughing is given in February and March before sowing. Two ploughings and two cross-ploughings with laddering, and one harrowing are sufficient preparation but previous aeration by occasional stirring continued for a long time is essential. The sowing time begins from February and is continued up to June depending on the character of the soil and amount of rainfall. In *bil* lands of North and East Bengal sowing begins in February. After a shower of rain the field is ploughed and the seed is sown by broadcasting at the rate of 4½ seers of *C. capsularis* and 3 seers of *C. olitorius* per acre; because *C. olitorius* seeds are smaller than *C. capsularis* in size. *C. capsularis* is sown earlier than *C. olitorius* and is also sown in low lands, but *C. olitorius* is sown on high lands. The seeds must be of 90 per cent germination but if it be less than this, more quantity of seed is needed. Early sowing gives the best result but for want of rain it is not sown in February in some parts of Bengal. By using larger quantity of seed per acre or by thicker sowing no better yield in fibre is obtained. The crop should be kept free from weeds during the first stages

of growth and should be thinned also. The distance from plant to plant should be about four inches. The cultivators use "Nirain" for loosening the soil and for thinning and weeding. Jute requires dry periods and rains alternately but it cannot bear drought very much. If there is no rain for fifteen or twenty days the growth of jute is checked at an early stage and may also wither away.

Harvesting:—Harvesting at the full flower stage when the seed pods are just forming, gives the best result. If it is cut earlier, the yield is less and the fibre is somewhat weak though white and more glossy. If it is cut later, the fibre is coarser and rougher, though the yield is slightly more. The plants are cut by sickles, and where there is 4 to 5 feet of water, jute is harvested by people wading and diving in water. In lower Bengal where the water rises up to 10 to 12 feet the plants are harvested earlier, so, the yield is low, but the fibre is more white and glossy.

Retting:—After cutting, the plants are made into bundles of about eight inches in diameter. These are either put immediately under water or kept a few days to allow the leaves to wither and fall. Steeping should be done in fairly deep, clear, sweet (not salt) but stagnant water. If steeping is done in running water a longer time is required for retting and the fibre is inflated with a gray deposit of iron salts. Salt water also delays the process of retting. If the bundles are spread in even layers as near the water surface as possible, the retting is uniform and usually takes about three weeks to complete. If steeped in shallow and dirty water the fibre is somewhat gray and it takes longer retting, specially if the jute is made into heap and is not entirely submerged in water. It takes three to four weeks to ret. Over-retting not only makes the fibre dark in colour but it also weakens it. If the jute is not rotted properly the green matter remains with the fibre and so when dried it forms black patches and this portion becomes very hard, so the jute fetches less price in the market. From the above it is evident that the bundles should be examined from time to time to get the proper retting. When the bark can be easily stripped and washes clean the retting is complete.

Stripping, Washing and Drying:—There are two methods of stripping.

(1) The stripper standing in clear water about 3 feet deep, takes a bundle of stems such as he can conveniently handle, and after removing as much of the bark as possible, by passing the stems through his hand, strikes the root ends of the stems with a short piece of bamboo about as thick as a wrist in order to completely loosen the fibre at the lower end of the stems. He now breaks the stems at a point about one third of their length from the bottom, and holding the bottoms with both hands, jerks the broken stems backwards and forwards in the water, with the result that two-thirds of the woody portion separates completely from the fibre and floats away. The portion of the fibre thus freed is th n wrapped round the hand and a similar series of jerks liberates the remaining portion of the stems.

(2) One man brings the bundles from the water and gives them to the females who are on the water side. The females take out the fibre of one or two stems at a time without breaking the stems. They are so expert that in this way they can separate one maund of jute fibre per day. By this method the woody portion called "pat-khari" is saved from spoilage. This is used as fuel.

After the stripping is over; the fibres are washed thoroughly in running water to get rid of adherent bits of sticks, bark, green matters, and all kinds of dirt. The excess of water is then wrung out from it The wet bundles of fibre are kept in a heap for one day and the exposure to the sun is given from the second day. This improves the colour of the fibre. The fibres are opened out in long strands and hung up in the sun to dry.

Yield:—Fifteen maunds of fibre may be taken as the average produce per acre, twelve maunds being the produce of early varieties and twenty maunds of the late varieties. In lower Bengal the average yield is from seventeen to eighteen maunds,

The Chemistry of Jute: - Jute may be called a ligno-cellulose, standing midway between cotton which is almost pure cellulose and lignose of woody fibre. Jute of good quality has the following composition (taken from "A Hand-book of Agriculture" by N. G. Mukherjee).

Cellulose ...	.. 64 to 70 per cent.
Pectose matters ..	... 24 to 28 ,, ,,
Mineral matters ..	... 0·2 to 2 ,, ,,
Fats and waxes ...	... 0·4 to 0·8 ,, ,,
Extractive matter	1 to 2 ,, ,,

The proportion of cellulose in jute is much less than in cotton. In fact, jute fibre when young is richer in cellulose but gradually this becomes partly converted into lignose.

Pests:—(1) The jute semi-looper—It is the most common pest of jute and does much harm. It is found in the rainy season. It is a small green caterpillar having black spots with white edges of the body and is generally called "Ghora poka" on account of its semi looping gait. It feeds on the upper shoots and young buds of the growing plants during June, July and August, and destroys them. The outbreak generally subsides after heavy showers of rain.

Remedy:—(*a*) Drag across the crop a rope moistened with phenyle water (2 *chittacks* of phenyle with 200 *seers* of water) held at opposite ends by two men. This will disturb the caterpillars and make the leaves distasteful. It should be done once a day continuously for two or three days

(*b*) Spraying with one ounce of lead arsenate with twenty *seers* (2 lbs.) of water destroys the insects. It should be practised twice or thrice at intervals of a week or so till the trouble is over.

(*c*) When insectivorous birds are found feasting on the caterpillars, they should be encouraged by putting branches of trees here and there in the field so that they can perch on them.

(*d*) The lands should be ploughed after the crop is harvested so that the pupa in the ground may be exposed and destroyed by the sun or eaten by birds.

(2) Jute hairy caterpillar—It also does much harm. The caterpillar is yellowish in colour and is covered with soft hairs all round the body. It attacks on both old and new leaves. As many as ten to fifteen caterpillars may be found in each leaf. It is found in June, July and August.

Remedy.—They can be controlled by picking up the leaves and destroying them by putting the leaves in water mixed with kerosine oil.

(3) Jute grasshopper (*Atractomorpha crenulata*). They eat the leaves but they do not do much harm.

Diseases:—(1) Root rot (*Rhizoctonia solavi* Kuhu). This is a distructive soil fungus attacking the roots. The presence of the fungus is shown by the plants withering and finally dying. Plants attacked with the disease show at first a yellowish patch just above the ground and then this darkens and tissues soften and collapse. Black rounded bodies (the sclerotia) are formed in the beginning at or below the ground level and are visible to the naked eye.

Preventive Measures:—(*a*) Liming red soil at the rate of 15 maunds per acre lessens the disease. Experiments in the Dacca farm show that soil deficient in potash suffers from Rhizoctonia. Application of water-hyacinth ash at the rate of 30 maunds per acre reduces the disease and increases the outturn.

(*b*) Following a rotation of crops reduces the chance of attack of this fungus.

(2) Black band disease (*Diplodia corchori* Syd.)—The affected plants show the formation of a dense black discoloured band round the stem at about two to three feet above the ground level. Such plants ultimately lose all their leaves and are left standing as dry black stems. As the disease advances, the bark of the main stem splits longitudinally and fibres turn brown and dry. Examination of the surface of a blackened stem shows the presence of minute spherical black bodies. The damage done is slight.

Prevention.—Affected plants should be carefully uprooted and destroyed.

(3) Chlorosis: It is the partial bleaching of leaves. It attacks a large proportion of jute. Its damage is considerable because the growth of jute is slowed down and it spreads very rapidly. After a considerable period of drought they appear on the plants but disappear after continuous rainfall for two or three days.

Remedy.—Its remedy is to cultivate disease resistant varities, *e.g.* D 386, D.154.

Conclusion.—Though by pure line selection some high yielding varities of jute have been isolated, yet this has not at all satisfactorily met the needs of the country. Further attempts should be made to isolate higher yielding varieties than the existing ones. They should also suit the various soils and climates of the country *e g.* the flooded lands of Lower Bengal. When other crops are being effectively improved by cross-fertilization, jute has mainly depended on selection for its improvement. Cross-fertilization and selection should go side by side for the improvement of the jute crop, as it is being done for sugarcane and wheat in Coimbatore and Pusa respectively.

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PRACTICAL DIFFICULTIES OF AN AGRICULTURAL GRADUATE RECENTLY EMPLOYED IN A. U. P. FARM.

" A letter to Manujee by Kunjachen"

DEAR MANUJEE,

In your previous letter you asked me to write to you about the practical difficulties I am facing as an employee of a Taluqdar (a landholder) of U. P. You wanted me to write especially with regard to those difficulties met with in the carrying out of the principles of farming which are taught at our Alma Mater, the Allahabad Agricultural Institute. For convenience sake I am grouping them as follows:

1. *Over-estimation of an agricultural graduate with consequent disappointment.*—The Taluqdars forget that agriculture is a vast science, which include almost all of the existing sicientific subjects. For example we need applied Physics, Botany, Zoology, Economics, etc., in our studies of Agronomy, Pomology, Agricultural Engineering, Animal Husbandry and Dairying, Entomology, Plant Breeding, Plant Pathology, Bacteriology, etc. They cannot understand that our science is one that deals with soils, plants, animals as well as man as a source of power and as a social being. They have changed for us the common saying, "Jack of all and master of none", to Jack of none and master of all". They take us to be encyclopedias of informations and expect us to have a thorough knowledge of everything starting from the radio to the sickle, not excepting the relation between quinine and mosquitoes, the purpose of the anti-tuberculosis campaign and the working of the Congress ministry.

Dear friend, when we tell them that we cannot cope with the above requirements, they become disappointed.

2. *Impatience*: - The first question put to me by my employer was, "What profit do you think you can make from a farm of 100 acres in the first year ?" How can I give him profit in farming before starting the farm ? Hence very politely I replied to him that I could give the answer a year after starting the farm. To my answer he asked me a sensible question, "Can you not study the conditions and make an estimate accurate enough ?" I answered that I could estimate the profit or loss, but that it will be more or less only an estimate. The word 'loss' created a peculiar facial appearance in him; and after a little thought he agreed to undertake the risk of making an estimate. After studying the existing conditions, I have submitted an estimate showing lo s for the first three years and later possible profits. I did not please my employer.

If we show profit in our estimate in the first year; after a year of our service, we may be kicked out, if the farm does not show profit. If we show a loss in our estimate, we shall not be employed. What to do, is a problem !

3. *Misunderstandings caused by agents of agricultural machinery*:—Somehow the agents of agricultural machinery have represented machinery and implements as "Demi-gods". A tractor, to my employer, is a power, that can plough, harrow, and do all other operations on a farm of unlimited size in the twinkling of an eye. He, till now, believed an incubator is a machine through one end of which you put eggs and through the other end you get chickens : very similar to a flour mill, where grains are put at one end and flour is taken out at the other. I have told him that agricultural machinery are labour-saving and not labour-ending. It seems that some agent of a tractor company told him a tractor can plough fifty acres of land 9 inches deep in a day of 8 hours with a nominal cost of Rs. 2 per day. These commission agents, in order to sell their machinery, exaggerate so much about the efficiency of their machines, that we are not believed when we give them facts. I believe if these men had given actual figures,

(*Continued on page 272*)

Book Reviews

The Punjab Fruit Journal.—A welcome and valuable addition to the scanty literature of Indian Agriculture is the Punjab Fruit Journal, now in its second year. It is published by the Fruit Development Board, Lyallpur, and while devoting some space to floriculture and landscape gardening, is primarily concerned with fruit growing. It contains English and Urdu sections, and thus meets the needs of a large number of people. The annual subscription is two rupees.

A special summer number has recently been issued, with an unusually interesting group of articles. The English section alone amounts to seventy pages. Features of unusual interest are a summary of research work in different parts of the world, and items of horticultural news.

It is encouraging that a journal of this sort has been successfully launched. Horticulture has long been a neglected phase of Indian agriculture, and while many people now realize its importance, little has been done to develope the industry. The Punjab has taken the lead in promoting scientific horticulture, and has now taken a further step in the right direction by publishing this journal.

W. B. H.

Potash Deficiency Symptoms.—Oscar Eckstein, Albert Bruno and J. W. Turrentine. 1937 Edition. (Verlagsgesllschaft fur Ackerbau, Berlin, Germany).

This is the second edition of a book which has become popular with agricultural workers in the Far East as well as in the United States of America. The book has not met with the same success in this country due to the fact that most Indian soils seem to contain enough potash to meet requirements of the plants. However, the book would be a very worthwhile addition to all agricultural libraries as it has thoroughly dealt with one very important aspect of crop growth, namely the adequate

supply of potassium, one of the three most important elements for the proper development of crops. It is with a view that agriculturists should ascertain as to whether their soils are deficient or not that the authors have taken great pains to try to explain as clearly as possible the phenomena associated with potash deficiency. The book, 222 pages in all, is very nicely bound and contains many attractive illustrations. But it is tri-lingual in that it is written not only in English but also in German and French.

B. M. P.

Practical Difficulties of an Agricultural Graduate Recently Employed in A. U. P. Farm

(*Continued from page* 270)

they could have sold more machinery. As it is, a man bought once but would never buy again. Thus we have to suffer for somebody else's sins.

4. *Conservatism:*—I went to see a few hundred acres of land with an idea of dividing it into convenient blocks for cultivating purposes. When I divided it into blocks for the efficient use of modern machinery, I am stopped because of a *peepal* tree (Ficus religiosa) or a *Murti* (an idol) here and another there. If I have to leave them as they are, I cannot divide them into proper economic blocks. Hence unless we have got the freedom to cut trees and plant trees, to put stones and take stones, the principles that we have studied are impracticable to be utilised in the actual fields. If these Taluqdars want to farm their land on modern lines with their conservative old ideas, it would be like stitching a new cloth to an old one or like putting new wine into old wine-skins. I believe it would benefit them if they take advantage of the old saying:

Never be first to accept a new idea,
Never be last to leave an old idea.

Let me close my letter with this note. "If India is to develope her agriculture, she must follow the methods which have been successful elsewhere".

Yours sincerely,
Kunjachen.

REPORT FROM THE DEPARTMENT OF AGRICULTURE, UNITED PROVINCES

FOR AUGUST, 1938

I.—Season—The rainfall in August was general though very unevenly distributed. It was below the normal in the western parts and a few other districts, while in the Benares and Gorakhpur Divisions and Oudh it was by far above the average, Azamgarh, Gonda and Bahraich recording as much as 20 to 30 inches. A statement giving the districtwise distribution of rainfall is appended.

II.—Agricultural operations.—Agricultural operations are generally up-to-date except in flooded areas and lowlying lands. Weeding of kharif crops, transplantation of rice and preparation of the land for the rabi are in progress.

III.—Standing crops and *IV—Prospects of the harvest.*—Standing crops are doing satisfactorily and prospects are favourable, except in places where they ha e been irrecoverably damaged by excess of rain and floods.

V.—Damage to crops.—Serious damage is reported from certain eastern districts and parts of Oudh owing to floods and incessent heavy rains.

VI.—Agricultural stock.—The condition of agricultural stock is on the whole satisfactory. Cattle diseases prevail generally and show considerable increase as compared with the last month. The following figures of cattle diseases and mortality have been furnished by the Director of Civil Veterinary Services:

Disease	July, 1938		August, 1938	
	Seizures	Deaths	Seizures	Deaths
Rinderpest	3,303	1,760	4,899	3,061
Foot and mouth	3,272	26	7,420	147
Haemorrhagic ..	3,594	2,692	5,485	4,090
Septicaemia..	..	..	..	

VII—Pasturage and fodder—Meerut apprehends scarcity of fodder which is also reported from flooded areas. Elsewhere it is sufficient.

VIII.—Trade and prices.—Prices of the chief food grains show slight fluctuation. The following figures compare the average retail prices in rupees per maund at the end of the month with thos of the preceding months.

	End of July, 1938	End of August, 1938
Wheat	2·772	2·697
Barley	2·038	2·011
Gram	2·460	2·404
Rice	4·082	4·008
Arhar dal	4·435	4·479

IX—Health and Labour in Rural Areas.—The condition of the agricultural and labouring classes is satisfactory except in the flooded areas. Cases of cholera and small-pox continue to be reported from a number of districts.

FOR SEPTEMBER, 1938.

I—Season—During the first half of September the monsoon was very active in north-eastern districts and the Benares and the Allahabad Divisions. Parts of Oudh also received unusually heavy rain in the early part of the month. The Meerut, Agra and Bundelkhand Divisions, however, continued to be almost dry generally during the whole of the month but particularly in its latter half. Taken as a whole the rainfall of the month was very unevenly distributed. It was in excess of the normal in Benares, Gorakhpur, and a large portion of Oudh: Elsewhere it was less than the average.

A statement showing the districtwise distribution of rainfall is appended.

II—Agricultural Operations.—Preparation of land for the *rabi*, harvesting of *kharif* crops and picking of cotton were in progress.

III—Standing crops and IV—Prospects of the harvest.—The condition of the standing crops is generally not satisfactory. The rainfall has either been in excess or has fallen completely short of requirements. Prospects of the harvest are not bright over a large area of the province.

V—Damage to Crops.—Crops over an unusually large area in the north-eastern districts and Oudh have been seriously damaged by standing water which did not subside due to the flooding of all natural drainage outlets and almost incessant rains. Fodder crops have been almost an entire failure in the flooded area. Sugarcane has suffered from disease as a result of continuous water-logging and Red Rot. In the Gorakhpur District the damage to the cane crops is estimated at Re.0-8-0 to Re.0-12-0 in the rupee.

VI—Agricultural Stock.—The condition of agricultural stock is generally satisfactory. The following figures of cattle mortality have been furnished by the Director of Civil Veterinary Services:

Disease	August, 1938		September, 1938	
	Seizures	Deaths	Sizures	Deaths
Rinderpest	4,899	3,061	6,030	3,282
Foot and mouth	7,420	147	9,898	175
Haemorrhagic	5,485	4,090	3,810	2,780
Septicaemia	...	..	..	..

These figures show that while the number of deaths from Rinderpest and Foot and Mouth have increased slightly, their is appreciable decrease in mortality from Haemorrhagic Septicaemia.

VII—Pastures and Fodder.—Fodder is reported to be sufficient except in flood-effected areas and the dry western districts.

VIII—Trade and Prices. Prices of the chief food grains show a tendency to rise. The following figures compare the average retail prices in rupees per maund at the end of the month with those of the preceding month.

			End of August, 1918	End of September, 1938
Wheat	..	..	2·697	2·385
Barley	..	..	2·011	2·183
Gram	..	..	2·404	2·737
Rice	..	..	4·008	4·032
Arhar dal	..	..	4·479	4·860

IX—Health and Labour in Rural Areas.—The condition of the people is generally satisfactory, except in the flooded area. Employment at good wages is available for the agricultural labouring classes. Cases of cholera and small-pox still continue to be reported from certain districts.

It is only by labour that thought can be made healthy, and only by thought that labour can be made happy; and the two cannot be separated with impunity.

You and I toiling for earth, may at the same time be toiling for heaven, and every day's work may be a Jacob's ladder reaching up nearer to God.

Alexander the Great, reflecting on his friends degenerating into sloth and luxury, told them that it was a most slavish thing to luxuriate, and a most royal thing to labour.